Vol. XXVII. Part 7.

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The Journal of the Department of Agriculture of Victoria, Australia.

July, 1929.

PRINCIPAL CONTENTS

Experimental Error of Field Trials in Australia

Budding, Grafting, and Inarching of Fruit Trees

Harvesting and Packing Passion Fruit

The Mealy Bug

Avian Tuberculosis

Lip and Leg Ulceration of Sheep

Orchard Hygiene

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OF

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VICTORIA, AUSTRALIA.

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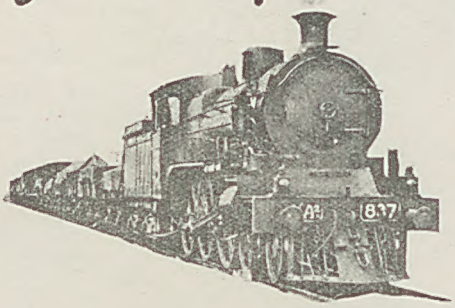

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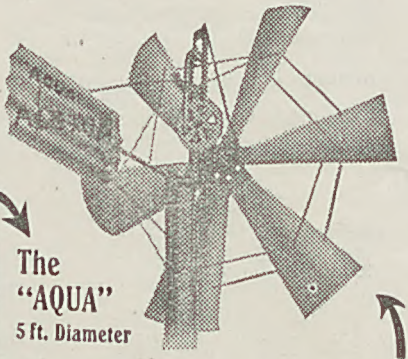

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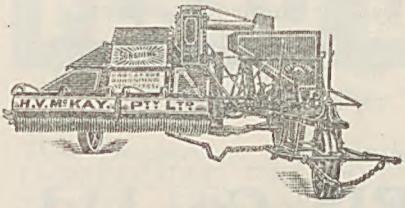

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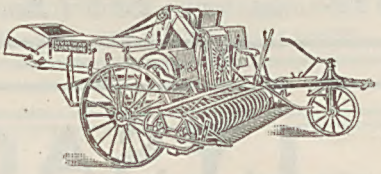

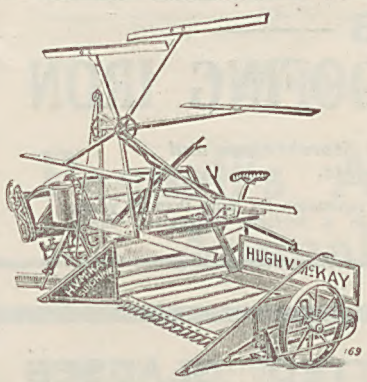

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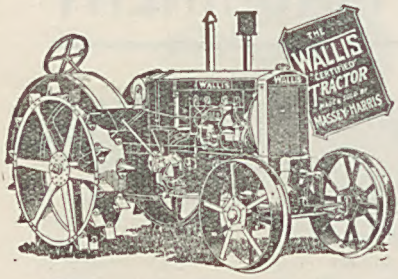

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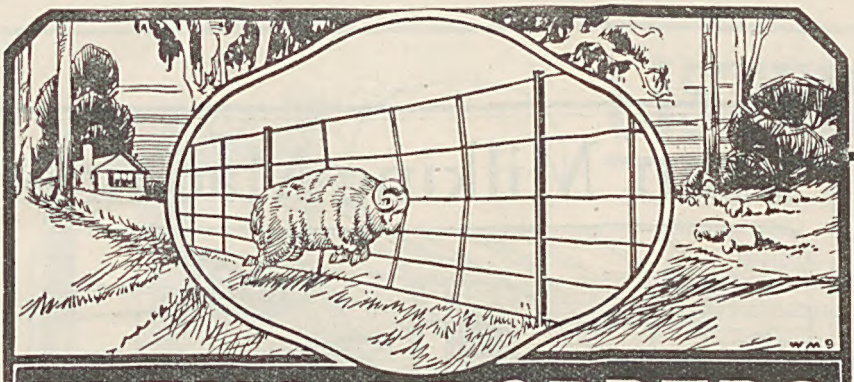

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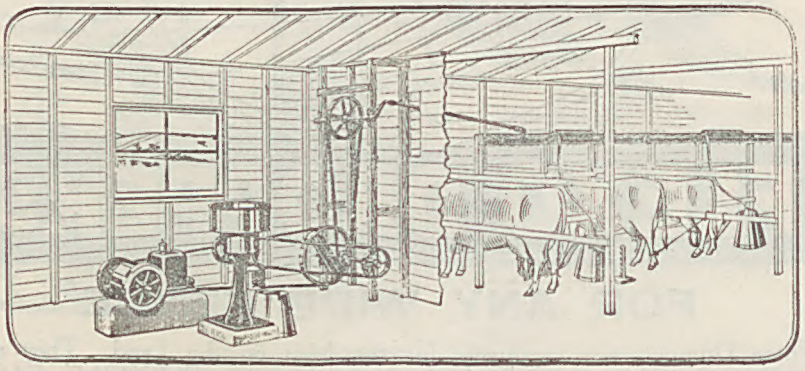

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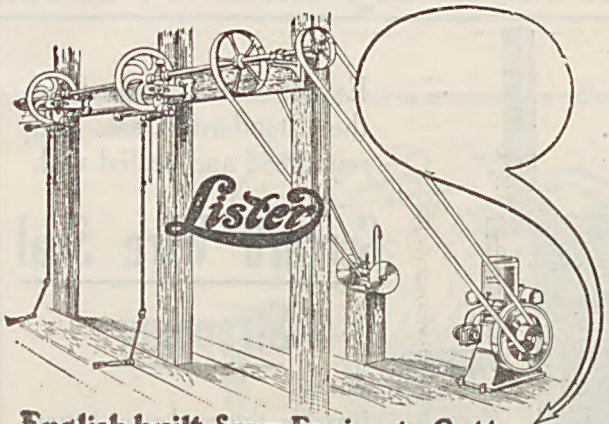

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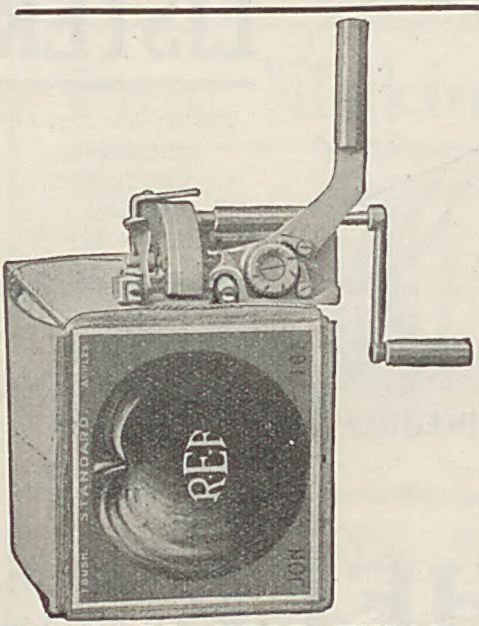

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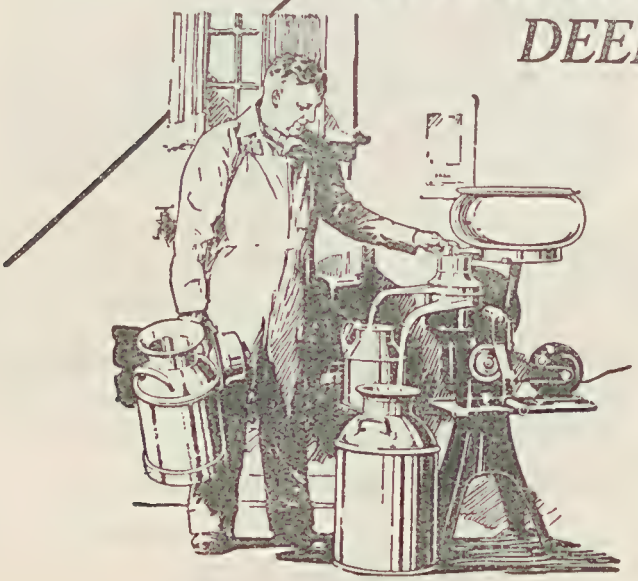

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THE JOURNAL

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Vol. XXVII. July, 1929. Part 7

EXPERIMENTAL ERROR OF FIELD TRIALS IN AUSTRALIA.*

By H. C. Forster, B.Ag.Sc., and A. J. Vasey, B.Ag.Sc., Agricultural Research Officers.

Introduction.

The question of the "Probable Error" in field trials is one which has in recent years come to the fore in connexion with the work of experimental stations in Europe and America. It has sometimes been suggested that in Australia the water supply available in the soil for the crop is often the limiting factor to growth and seed production. This might lead to a more uniform growth, and thus the experimental error of plot observations might be thereby diminished. It seemed, therefore, worth while to investigate the matter fully, and with this end in view the classic experiment of Hall and Mercer was repeated at the State Research Farm, Werribee, Victoria, it being felt that such an investigation should lead to valuable results which would be a guide for the future in the "lay out" of the trial plots.

The experiment was undertaken to determine—

(1) the variation in an apparently uniform acre of wheat as measured by the "Standard Deviation" and the "Probable Error" of 1/160th acre plots,

(2) the optimum
- (*a*) size,
- (*b*) shape,
- (*c*) number of plots necessary to reduce this error to a minimum.

Method.

During the season 1926-27, the North Railway Field at Werribee was planted with "Free Gallipoli" wheat, and it produced a fair average crop, which was, before harvest, expected to yield about 24

* Paper read before the Royal Society of Victoria, October, 1927.

bushels to the acre. An acre of this was selected for the experiment, and many casual observers were agreed that as far as the eye could judge, it was an even area of wheat.

A preliminary survey was made on the 29th November, 1926, when it was observed that the drilling was somewhat irregular. There was one double-sown row in every stroke of the drill, and therefore it was decided to include two of these double-sown rows in each plot. Accordingly each plot was made 30 x 20 links, and the dimensions of the whole acre, 300 x 320 links, excluding paths. Further it was found that near the western boundary of the acre, a strip a few yards wide had been damaged by cart-tracks. This was consequently excluded.

A straight row on the western side of the acre was taken as a base-line, and from this all measurements were set off. These allowed for the division of the acre into four quarters by means of two intersecting paths.

On account of the danger of shaking-out by storms before the harvesting of the whole area had been completed, an occurrence which would have wrecked the whole experiment, it was deemed advisable to mark out only one quarter-acre at a time. This was then harvested immediately. Owing to extremely favourable weather conditions during the harvesting period, such precautions proved unnecessary.

Along the boundaries of each quarter-acre pegs were put in corresponding to the corners of the outside plots. The boundaries of each 1/160th acre plot were then defined by stakes, whose positions were obtained by sighting from the outside pegs. Paths were then cut in a N.-S. direction, dividing the quarter-acre into 5 strips of 8 plots each. These paths were 4 drill-rows wide, and were made by hand-cutting 2 rows on each side of the actual boundaries of the plot as defined by line and plumb-bob. As the bags for the reception of the produce from each plot had previously been marked, the crop cut in the formation of the paths was transferred immediately to the corresponding sack.

Cutting was commenced on the 22nd December with a single-horse mower fitted with a carrier arrangement. The mower was driven in an E.-W. direction across the paths, thus cutting five plots. It was stopped in each pathway—specially cut for this purpose—to enable the crop cut from each plot to be bagged straight from the carrier. After four swathes of the mower, a strip of about one foot was left along the northern boundary of each plot. This was cut by hand, the exact boundary being defined by line and plumb-bob as before. Plots were then thoroughly gleaned for any heads that had been broken off, as well as any loose straws.

Before cutting, the plots were examined for the number of rows they contained, and for the presence of any disturbing factors. There were very few weeds. In a similar manner the other three quarter-acres were harvested, the bagged produce of the plots being carted and stored as the harvesting of each quarter-acre was completed. Field work was finished on the 7th January, 1927.

Thrashing was commenced on the 18th January. This was performed by means of a motor-stripper, which consisted of the drum

and beaters of a typical Australian harvester, driven by a stationary engine mounted on the same under-carriage. After thrashing the wheat fed into the beaters, both straw and grain were delivered into a bin at the rear. Here the straw was collected, and later re-thrashed separately from the grain. The grain was winnowed to an even sample, and weighed to the nearest ounce, which was considered the limit of the overall accuracy of the experiment. Thrashing was completed on the 27th January.

Results and Discussion.

TABLE 1.—PLAN AND WEIGHTS IN OUNCES OF GRAIN HARVESTED FROM 160 WHEAT PLOTS.

S

125	117	125	135	159	139	150	164	143		157
121	135	123	147	147	130	141	154	144		161
124	137	126	135	142	142	138	135	139		136
125	134	127	130	144	133	141	147	142		147
128	135	121	136	138	140	135	149	139		139
132	127	118	134	135	137	137	138	127		145
137	133	122	131	120	137	139	142	133	tracks	148
141	128	130	126	119	149	143	132	133		144
E										W
123	123	119	120	111	139	152	142	140	Cart	143
115	125	135	121	125	143	143	135	143		146
121	120	133	132	128	144	133	127	137		137
137	123	141	124	128	135	139	139	137		142
127	131	136	121	135	135	133	135	133		131
122	124	144	132	128	136	143	145	143		142
122	108	141	143	125	139	148	150	152		154
130	135	161	154	154	153	141	130	152		161

N

Table 1 shows the yields of plots together with their position in the field. The yields varied from 108 to 164 oz., the variation being 20.6% on either side of the mean. The frequency curve as shown in Figure 1 was obtained by grouping the yields into periods of 5 ounces each.

With the curve from the actual results is shown the normal curve of error calculated to fit the results. Owing to the small number of observations, the approximation of the actual curve (*vide* Figure 1) to the above is considered close enough to justify the conclusion that the material was homogeneous, and that the formulae applicable to such may be used in this case.

A study of Table 1 shows that there is a definite rise in yield from East to West, while the variations from North to South are apparently irregular. The graph (Fig. 2) of the sum totals of the rows of plots, as set out in Table 2, verifies these conclusions.

It is necessary to consider briefly these disturbing elements before proceeding to the main discussion and conclusions.

The presence of such a regular rise in the field under observation is a factor which has appeared in most investigations of this character. In their Mangold experiment, Hall and Mercer had a similar experience in a variation from North to South of 7.3%, which, after being

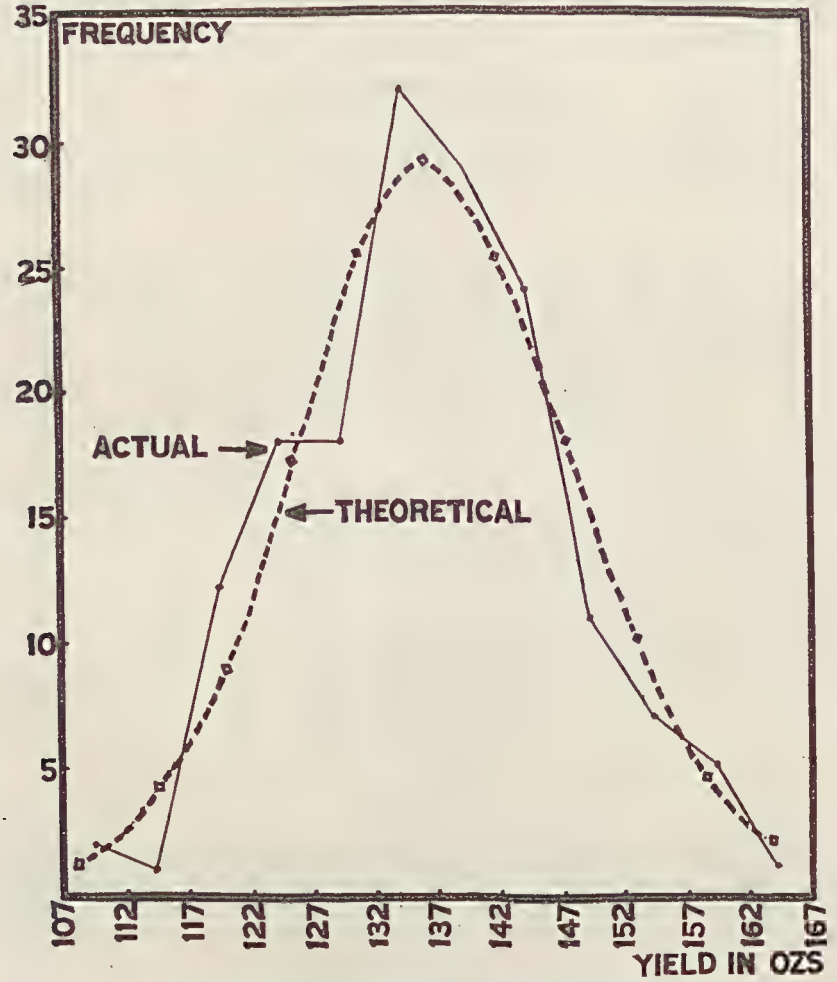


Fig. 1.—Frequency Curves for 160 Wheat Plots.
(Actual and Theoretical.)

observed and noted, was subsequently disregarded in the calculation of results. In this case, there is a variation from E.-W. of 6.9% on either side of the mean. The irregular variation from South to North is similarly 5.9%. Since these variations, viz., 6.9% from E.-W., and 5.9% from S.-N., are of approximately the same order, it is possible in a similar manner to disregard this regular variation from side to side.

Table 2.—Varying Weight of Rows of Plot Yields.

South-North.	East-West.
1414 oz.	2030 oz.
1403 „	2035 „
1354 „	2102 „
1370 „	2121 „
1360 „	2138 „
1330 „	2231 „
1342 „	2256 „
1345 „	2264 „
1312 „	2237 „
1331 „	2333 „
1312 „	
1345 „	
1317 „	
1359 „	
1382 „	
1471 „	

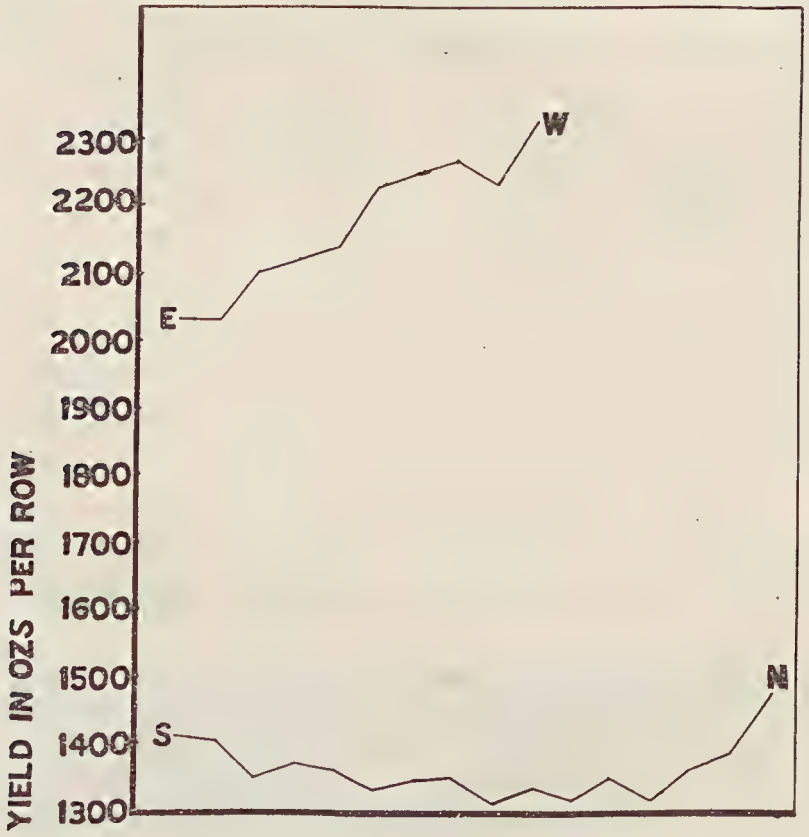


Fig. 2.—Varying Weights of Rows of Plot Yields.

Hall and Mercer in their experiment measured each plot as a definite distance along a certain number of rows, thus taking area of crop as their unit. On account of the irregular drilling, it was impossible in this experiment to include a definite number of rows in each plot; therefore area of land was taken as the unit.

The Variation in an Apparently Uniform Acre of Wheat as measured by the Standard Deviation and the Probable Error of 1/160th Acre Plots.

TABLE 3.—CALCULATION OF THE STANDARD DEVIATION.

Group.	Frequency. f	Deviation from Arbitrary Mean. x	x^2	fx	fx^2
107–111	2	−5	25	−10	50
112–116	1	−4	16	−4	16
117–121	12	−3	9	−36	108
122–126	18	−2	4	−36	72
127–131	18	−1	1	−18	18
132–136	32	0	0	0	0
137–141	29	1	1	29	29
142–146	24	2	4	48	96
147–151	11	3	9	33	99
152–156	7	4	16	28	112
157–161	5	5	25	25	125
162–166	1	6	36	6	36
Totals	160	—	—	65	761

The examination of the number of drill rows showed a variation of from 33 to 35 rows per plot. This variation, 34 ± 1, is of the order of 3%. On taking only those plots containing 34 rows, the yields varied from 115 to 164 ounces, a range of approximately 18% on either side of the mean. Thus the normal variation due to chance is far greater than the difference that could be produced by such variation in the number of rows, and this may therefore be grouped with these

chance errors. A more accurate comparison may be drawn between the Standard Deviation of all the plots (S.D. = 10.9 ± 0.41 oz.), and that from those containing the same number of rows (34), S.D. = 11.9 ± 0.58 oz.). These two figures are of the same order. Now, since this S.D. is a measure of the variance of the plot yields, the above assumption is confirmed.

It may be calculated by the usual formulae that the mean yield of the 1/160th acre plots is 136.5 ± 7.3 oz., i.e., there is an even chance that the yield from any one plot will be between 143.8 oz. and 129.2 oz. Further that if a comparison were made between a pair of 1/160th acre plots of two different varieties of wheat on similar land to that found here, any differences between the yields of less than 23.3 oz. (17.7% of the mean), would not be significant.

Optimum Size of Plot.

In order to determine the optimum size of plot for purposes of yield trials, i.e. that size of plot which will give the least variation from the mean, it was necessary to compare the S.D. of different sizes of plots. By the grouping of adjacent plots, the yields from areas of different sizes have been obtained. The method of grouping is indicated by the accompanying dimensions in Table 4.

TABLE 4.—THE STANDARD DEVIATION (%) OF PLOTS OF VARIOUS SIZES.

Size of Plot.	Number of Plots.	Dimensions.	Standard Percentage Deviation.
		links.	%
1/160th	160	30 × 20	8·0
1/80th	80	30 × 40	7·0
1/40th	40	60 × 40	5·8
1/20th	20	80 × 60	5·2
1/10th	10	80 × 120	4·6

N.B.—The small number of results in the two latter cases detracts somewhat from the reliability of the figures 5.2 and 4.6% respectively.

From the above table and the following graph, it will be noted that the S.D. (%) falls rapidly from 8.0% in the case of the 1/160th acre plots to 5.8% at the 1/40th acre plots. Further increase in size up to 1/10th acre only reduces this quantity to 4.6%. Now, since the larger the area, the greater the difficulty in obtaining an "apparently uniform" area of soil, it follows that little is to be gained by increasing the size of plot for yield trials above 1/40th of an acre.

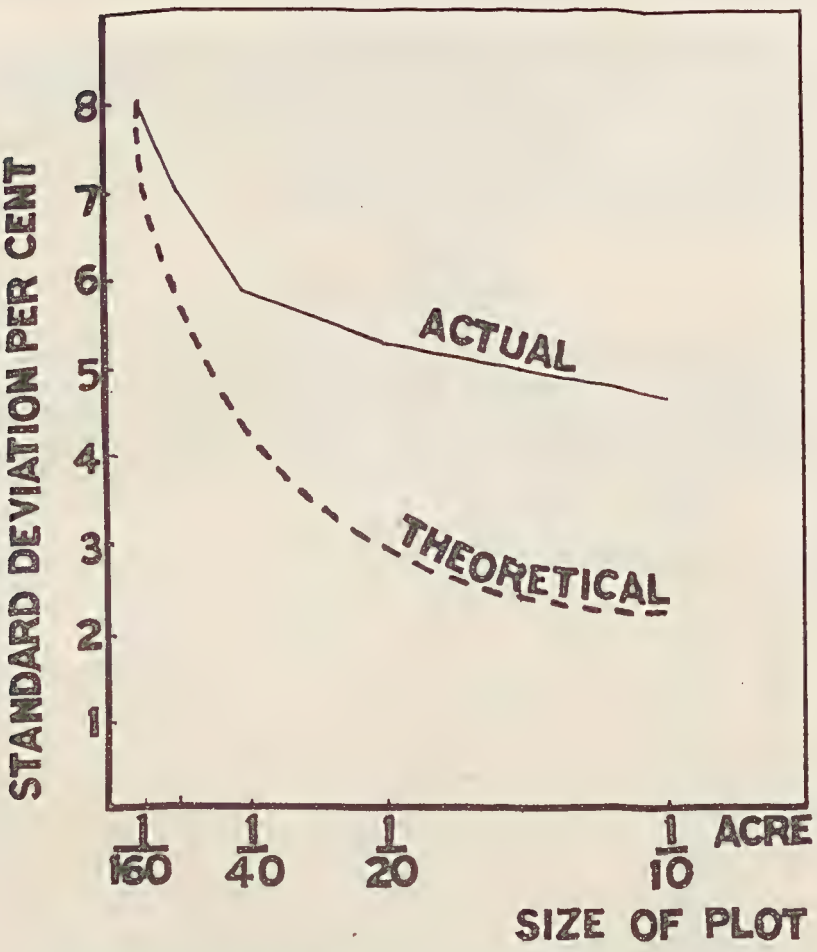


Fig. 3.—Actual and Theoretical Curves of the Standard Deviation of Plots of Various Sizes.

N.B.—The theoretical curve is obtained by the division of the S.D. of the 1/160th acre plots by the square root of the number of the original number of small plots combined in each grouping.

Optimum Shape of Plot.

It is generally considered that a long narrow plot is more desirable for field-scale work than a short square plot, and the following table tends to establish this belief.

TABLE 5.—STANDARD DEVIATION OF PLOTS OF VARIOUS SHAPES.

Size of Plot.	Number of Plots.	Dimensions.	Standard Percentage Deviation.
		links.	%
1/40th acre	40	60 × 40	5·8
1/40th acre	32	20 × 120	5·0
1/20th acre	20	80 × 60	5·2
1/20th acre	16	20 × 120	3·7

It is important to note that on account of the gradual increase in yield from east to west, plots with their axis in a north to south direction cannot be used in the above comparison.

Optimum Number of Replications Desirable.

Having determined the size and shape most desirable from a practical standpoint, it is necessary to find the number of replications required for a working minimum of error. The S.D. was then calculated for two scattered 1/20th acre plots, four scattered 1/40th acre plots, etc. Maximum scattering was obtained by entering the yields of the various sized plots on slips of paper, which were later drawn from a bowl, and thus the various sets of pairs, fours, eights, &c., were made up.

TABLE 6.—STANDARD DEVIATION OF 1/10TH ACRE PLOTS OBTAINED BY RANDOM GROUPING OF VARIOUS NUMBERS OF UNITS.

Number of Units in 1/10th acre plot.	Number of Observations.	Standard Deviation.
		%
1	1	4·6
2	2	4·0
4	4	3·18
8	8	2·46
16	16	2·3

N.B.—Only a low reliability can be placed on the figure 4.6, due to the small number of results.

From this it would appear that a greater number of replications than four or five is not warranted, as the small increase in accuracy so obtained would entail a great amount of extra work.

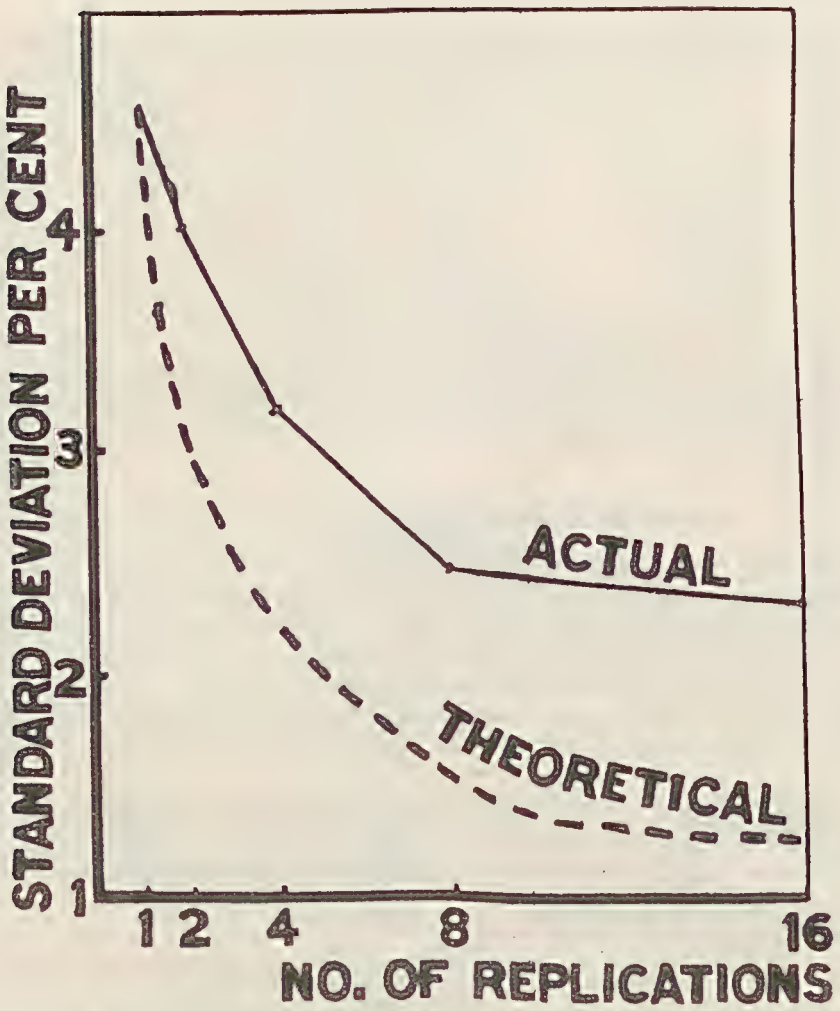


Fig. 4.—Relation between the Standard Deviation and the Number of Replications. (Actual and Theoretical.)

N.B.—The theoretical value is obtained by the division of the S.D. of 1/10th acre plots by the square root of the number of units into which it was divided.

Conclusions.

While the small number of observations necessarily detracts from the accuracy of some of the results, the following conclusions seem to be justified, supporting, as they do, most of the previous work overseas.

(1) That in this field experiment, there are two types of error—

(*a*) casual, due to small chance errors in harvesting technique, uneven seeding, manuring, hare-tracks, &c. These may be so gradual as to be inappreciable to the eye.

(*b*) more regular errors, due to marked soil variations, climate, &c.

(2) That the casual error attaching to a single plot decreases with the increasing size of plot, but the more systematic error of soil variation becomes more important as the plot increases in size.

(3) The optimum size for field trials for cereals under conditions such as these is 1/40th acre.

(4) That there would appear to be grounds for the belief that a long narrow plot is the more desirable for field trials.

(5) That the error attaching to a 1/40th acre plot is diminished to a working minimum by a replication of five times in any one series.

It is absolutely essential that these results be applied with caution. They are only of value for the conditions which prevailed during the period of the experiment, on the particular soil on which the experiment was conducted. Thus in the first place they will apply only to areas of crop in which *the eye is unable to detect any serious lack of uniformity.* If a field, used for yield trials, contained areas in which the crop was locally affected owing to disease, extra-heavy rain or some other exceptional circumstance, there would be no reason for expecting that the statistical results obtained in the Werribee work would hold good in such an area.

In the second place, with different climatic conditions the results might be different, but the marked similarity between the results at Werribee and at Rothamsted suggests that this is not likely to be a very serious source of trouble.

Finally, the authors wish gratefully to acknowledge all assistance received. The experiment itself was undertaken under the direction of the Department of Agriculture, Melbourne, at the suggestion of Mr. H. A. Mullett, Superintendent of Agriculture.

They are also greatly indebted to Professor S. M. Wadham for his many suggestions and helpful criticism of this report.

The facility and accuracy obtained in the field work would have been impossible but for the assistance of Mr. A. Morgan, B.Ag.Sc., and Messrs. Pescott and Skene, students in Agriculture in the University of Melbourne.

BUDDING, GRAFTING, AND INARCHING OF FRUIT TREES.

(Continued from page 302.)

By J. M. Ward, Superintendent of Horticulture.

GRAFTING—*continued.*

THE MAKING OF GRAFTING WAX.

There are several recipes for making grafting wax. A simple one that can be recommended is to melt together 1 lb. tallow and ¾ lb. resin. This can be used hot or cold.

Fig. 19.—A Strap Graft, two years old.

The "strap" of growth on the right; that on the left is one year old. Two scions have been placed on the branch on the right. The branch on the left was not cut down until a year later than that on the right.

Fig. 20.—A Close-up View of Grafts shown in Fig. 19—Two-year-old Scions.

The "strap" will quickly cover the whole of the cut surface.

If waxed calico is preferred, 6-inch strips of cheap calico can be dipped into the hot wax, and when thoroughly soaked, the strips should be immediately drawn through two pieces of wood, so as to remove the surplus wax. The waxed calico can, when cold, be torn into strips of the desired width.

PREPARING THE TREE.

In preparing a tree for the purpose of grafting, it can be cut down either a few weeks before the grafting is to take place or on the same day, as is convenient. It was generally understood at one time that for

Fig. 21.—View of an Established Apple Tree which was Cut Back and Re-worked.

This tree was "strap" grafted three years before photograph was taken.

Fig. 22.—An Instance of an Apple Tree cut down to a Single Trunk and then Grafted by means of the Strap Graft.

The tree was top-worked when young; without this, success may not have been attained.

grafting to be successful, the tree should be cut down a month or more prior to putting on the scion, but it is now known that there is no reason for this supposition.

Although it has been practised to some extent in the past, the writer does not recommend cutting the tree hard back to a single trunk for re-working purposes. A number of successes have been achieved

Fig. 23.—Same Tree as shown in Fig. 22, some 12 or 15 years after Grafting.

Fig. 24.—A London Pippin top-worked to Granny Smith in Western Australia.

A similar tree, but smaller, yielded 16½ unpacked cases the fourth year after grafting. Note unusual method of staking the grafts.

by doing this (see Figures 23 and 24); more failures, however, than successes have resulted from the practice. This has been particularly noticeable in orchards in Tasmania in instances where the method has

Fig. 25.—A Waterloo Seedling Apple Tree grafted to Tasma (Democrat) in 1922.

Grafting was carried out high up on the branches, and a considerable number of scions were grafted on each limb, and a quick change-over of varieties resulted. In 1927 this tree yielded 28 cases. Photograph was taken November, 1928, at Mrs. H. D. Calvert's orchard "Waterloo," Huon, Tasmania.

Fig. 26.—An Apple Tree cut hard back and grafted, which became affected with *Polystictus versicolor*.

Photograph taken at Brook's Bay, Tasmania.

Fig. 27.—A Close-up View of the Tree shown in Fig. 26.
Note the injurious effect from attacks by the fungus *P. versicolor.*

Fig. 28.—An Apple Tree in the Same Orchard as are those shown in Figs. 23 and 24, only partly cut back.

Numerous scions were grafted on to each branch. There is no sign of any attack by *P. versicolor.*

Fig. 29.—An instance where an Apple Tree has been re-worked high up.
All the new growth is from either grafts or inserted buds.

Fig. 30.—To overcome the attacks of *Polystictus versicolor* and to quickly change one variety to another, a large number of buds and scions have been put into this tree.
All the new growth is from scions and buds.

Fig. 31.—Several hundred buds and scions have been placed on this Apple Tree. All new growth now showing is from these scions and buds.

Fig. 32.—Bridge Grafting on an injured trunk of a Pear Tree. Scions in place ready for tying and waxing over.

Fig. 33.—Inarching Young Stock planted at foot of an injured trunk and grafted on to the tree, and ready for tying and waxing.

been adopted. Very few growers who re-work apple trees now cut all the branches down to the trunk.

The practice now recommended is to cut some branches back; these should be grafted. The uncut branches should be left until the grafts make good growth, say, two to three years later. The branches left act as sap "safety valves." It has been found that when old-established apple trees are cut hard back for re-working, particularly in the Huon district, Tasmania, and a number of districts in Victoria,

Fig. 34.—This tree had a weak rooting system. A seedling stock was placed at the foot of the tree and grafted on to the foot of the trunk. The new stock grew rapidly and soon put new vigour into the tree.

Sometimes two or more stocks are planted, and worked into the trunk, as in Figs. 33 and 35.

they become affected with the fungus *Polystictus versicolor,* which appears to quickly kill apple trees in this condition (see Figures 26 and 27). To overcome this trouble the tree receives what may be called a hard pruning, and numerous scions are grafted on to every branch, on both old and young wood. Some growers also bud as well as graft the new wood. In some instances from 100 to 200 buds or grafts have been placed in the one tree. (See Figures 29, 30 and 31).

It is hardly necessary to state that a good deal of work is required in the removal of new growth from the original variety, particularly during the first spring after budding or grafting takes place. Such work is usually termed disbudding. Nevertheless this method of changing one apple variety over to another is one that can be highly recommended for two reasons—(1) to overcome the problem of effect of *Polystictus versicolor* on beheaded apple trees, and (2) to quickly change one variety over to another with the minimum loss of crops during the changing-over period. This system can also be recommended for pears, but is not satisfactory for other fruit trees.

In the re-working of apricots, peaches, almonds, oranges, lemons, and other citrus fruits, the trees are cut down to within 6 to 12 inches

Fig. 35.—A Pear Tree in Oregon, U.S.A., affected with pear- or fire-blight *(Bacillus amylovorus)*.

The diseased portions of the trunk and roots were cleaned out and treated, and new stock was planted and worked on to the trunk.

of where the main arms fork out from the trunk of the tree, and buds are inserted into the new growth that results from the cutting down process.

Grafting of these varieties of fruit trees is not so successful as budding. The writer, however, has seen some great successes in top-working peach trees, by grafting, in the Stanhope (Queensland) district.

Plum trees—like the apple and pear—can readily be budded or grafted. When obtaining buds or scions, the operator should secure them from trees producing the very best type of fruit. The health and productivity of the tree should also be taken into consideration.

INARCHING OR BRIDGE GRAFTING.

"Inarching" and "Bridge" grafting has, for many years past, been largely practised in Canada and the United States of America, but has not been in vogue in Australia to any extent.

These grafts are used chiefly to "repair" trees that have been damaged, or in the case of a tree whose root system is weak or has been injured.

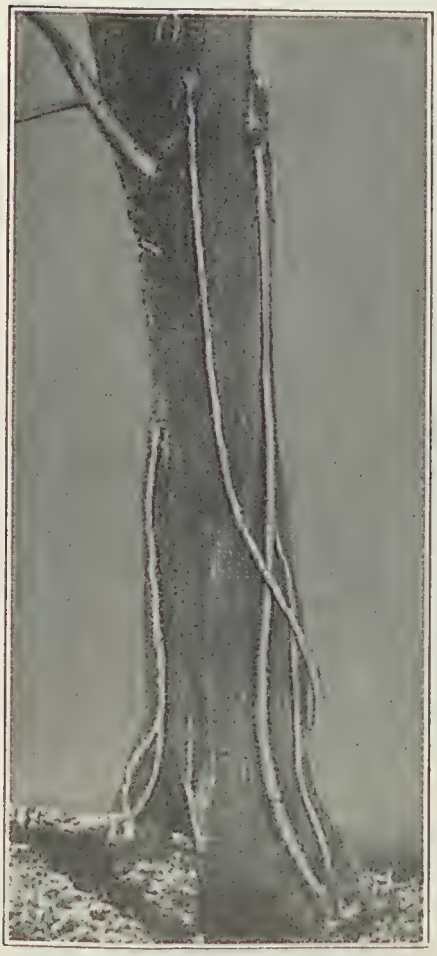


Fig. 36.—A Pear Tree injured as that shown in Fig. 33, but in this case grafting has been carried out instead of inarching.
Photo. from U.S.A. Department of Agriculture.

Fig. 37.—Trunk of an injured Orange Tree which has been "bridge-grafted."
Photo. from Circular No. 273 by R. W. Hodgson, University of California.

The method is simple, yet very effective. Figures 32 to 37 explain the system of "inarching" and "bridge" grafting fairly well. Both these methods of grafting could, with benefit to fruit-growers, be used to a considerable extent in many orchards throughout Australia. One prominent apple-grower in Stanthorpe, Queensland, has inarched many of his weakly-growing apple trees with successful results. He merely

planted one or more apple seedlings at the foot of each weak-growing tree (due to a poor root system), and grafted it on to the tree trunk with the result that the tree was given renewed vigour.

Bridge grafting is usually put into effect in instances where trees have been injured by hares or rabbits eating away the bark, or by cultivating implements, and where trees have been affected by disease. The damaged portion (provided any disease present has been eradicated and the wound cleansed) can be healed up by bridge grafting.

In preparing the parts that are to be "bridged," it is essential that they should be thoroughly cleansed and dead or diseased bark cut away. The scions should be a little longer than the part that is to be "bridged."

Fig. 38.—Limbs braced by twisting laterals together.

The scion is prepared by bevelling both ends in a somewhat similar manner to that described for the "bark" graft (see this *Journal* for May, 1929), except that the sloping cuts are usually longer and possibly a little thinner than those on the scions used in the bark graft; the thin wedged ends allow the scion to be thrust under the bark of the trunk fairly easily and without damage to the cambium layer. A cut is made in the bark of the stock—tree—similar to that seen in Fig. 32.

The scions, as in all grafting, are securely tied and waxed over. Occasionally inarching is done for the purpose of bracing limbs together; this operation is performed by bringing and twisting together two fairly strong-growing laterals from the two limbs that are to be braced. These limbs are temporarily braced with wire, rope, or other material, and the laterals twisted together and firmly tied; having been kept in that position for a year or two, they will unite and remain permanently braced. See Fig. 38.

(To be continued.)

HARVESTING AND PACKING PASSION-FRUIT.

FOR LOCAL MARKET AND FOR EXPORT.

(*By Basil Krone, Fruit Packing Expert.*)

Until recently the grading and packing of passion fruit was regarded as superfluous. Experience during the last few years, however, has shown that attention to these details pays handsomely. In some instances as much as 5s. per case and 3s. per half case has been the difference between the price paid for carefully graded and packed fruit and the price of the ordinary "orchard run."

The market of to-day definitely proves that in every consignment of ungraded, unpacked passion-fruit, the producer not only loses pence, but shillings per case. Therefore, it is desirable that all grades and packs be standardized.

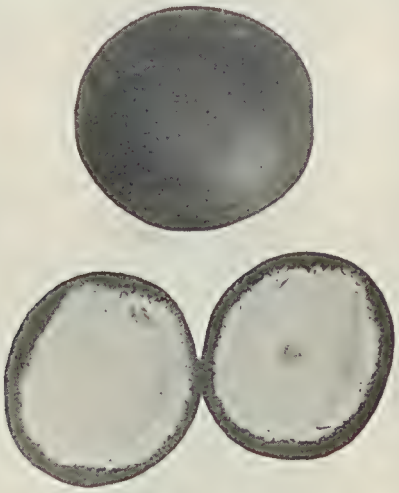


Fig. 1.—A "Dummy" Passion Fruit.

Harvesting.

Successful marketing of the passion cannot succeed without good harvesting. The degree of maturity at which the fruit is picked is vital.

1. At the beginning of the season the fruit should not be gathered until it has completely changed to its darker colour, but long before any sign of shrivelling appears.

2. As the season advances the fruit should be gathered when it is a little more than three parts suffused with colour. This degree of maturity will ensure the complete development of the ripening process, and the fruit will be quite black by the time it reaches the market.

3. In hot districts the fruit should be gathered while in the state of development suggested in the previous paragraph, and, when possible, this operation, as well as the packing, should be conducted in the *very* early morning or late evening.

4. In some hot districts it has been found preferable to pack the fruit, lid the cases, pile them closely together, and cover the stack with

damp bags until just before they are to be removed to the train rather than to leave the fruit on the bench, say, overnight.

5. The fruit should be harvested daily. The wind-falls should be picked up first; a couple of hours in the hot sun will ruin this grade.

6. Passion-fruit must always be handled carefully so as to avoid damaging the cuticle.

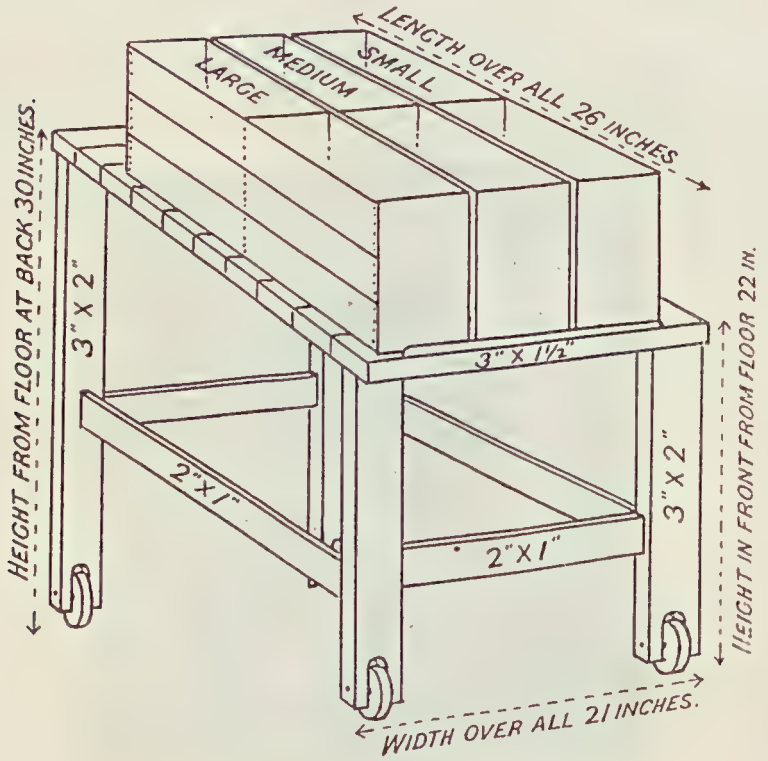


Fig. 1a.—A Packing "Trolly".

Grading.

Strict attention must be given to the elimination of "dummy" fruit. These may be discerned by their extremely light weight, and with a little practice the packer can easily detect them. Shrivelled passions should never be packed in the same case as fresh fruit.

No regulations dealing with the grading and packing of passion fruit have been made, but it is suggested that they be sorted into three grades, namely:—

Special.—Large sized (full of pulp) and free from "dummy," "woody," or shrivelled specimens.

Standard.—Medium sized (full of pulp) and free from "dummy," "woody," or shrivelled specimens.

Plain.—Small sized (full of pulp) free from "dummy" specimens, but this grade may include those of any size that are shrivelled or affected by "woodiness" of the skin.

Sizing.

This is best carried out during the operation of packing, when cases to hold large, medium and small sizes respectively can be placed side by side and packed at the same time this will facilitate the work. Fig. 1A gives an idea of how the work can be arranged for the comfort of the packer.

Grading passion fruit is made easier if three cases be packed at the same time, and filling them with large, medium, and small-sized fruits respectively.

Packing.

The increasing popularity of the "diagonal" pack is a proof that it has found favour amongst passion-fruit growers. With this system the quantity of fruit in a case can be ascertained at a glance, and thus buying or selling by counts or dozens is facilitated.

Fig. 2.—Correct method of placing first and second layer of the 2–2 pack in the Long or Half Long Bushel Case.

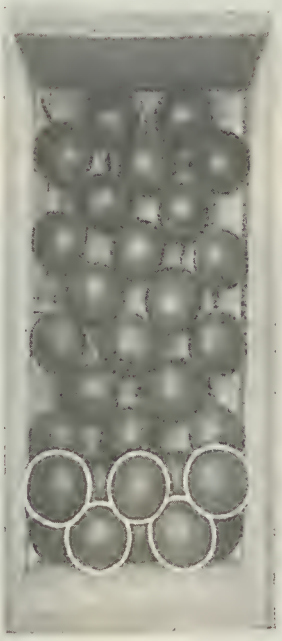


Fig. 3.—Correct method of placing first and second layer of the 3–2 pack in the Long or Half Long Bushel Case.

Fig. 4.—Correct method of placing first and second layer of the 2–1 pack in the Long or Half Long Bushel Case.

The fruit in the second and succeeding layers should rest in the pockets or spaces caused by the fruit beneath, and not directly on top of them.

Note.—All stalks in the 2–2 and the 3–2 packs face in the same direction except the last fruits in each layer, which are reversed. All stalks in the 2–1 pack face the centre, otherwise the fruit will not reach the desired height when the packing of the case is finished.

Cases.

New cases and white lining paper enhance the value of the fruit. Specifications of the cases used should be as follows:—

Long Bushel Case.—26 x 6 x $14\frac{1}{4}$ inches (inside measurements clear of the division).

Half Long Bushel Case.—26 x 6 x $7\frac{1}{8}$ inches (inside measurements clear of the division).

Half Dump Case.—18 x $8\frac{2}{3}$ x $7\frac{1}{8}$ inches (inside measurements).

THE LONG BUSHEL AND HALF LONG BUSHEL CASES.

Packing passion-fruit is a very simple process. Those who use the Long Bushel or the Half Long Bushel case will find that the 2-2 (two-two) packs will pack most of their fruit, while it may be necessary to employ one or two 3-2 (three-two) packs for the very small sizes, and perhaps one or two 2-1 (two-one) packs for the very large sizes for the packing of the Black Mammoth variety.

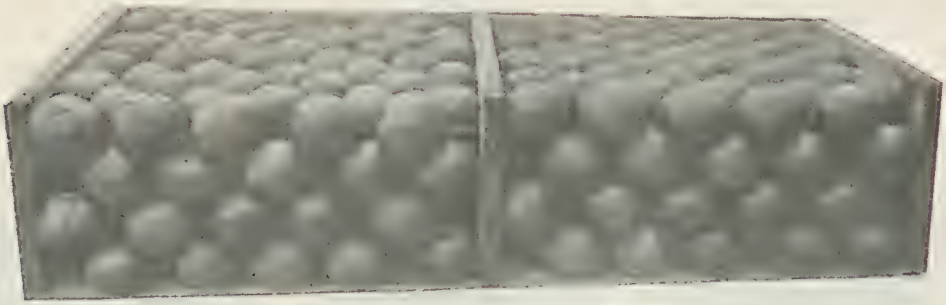


Fig. 5.—The 2-2 pack, 5 x 5 layer, 10 layers. Total 400 or 33 dozen and 4.

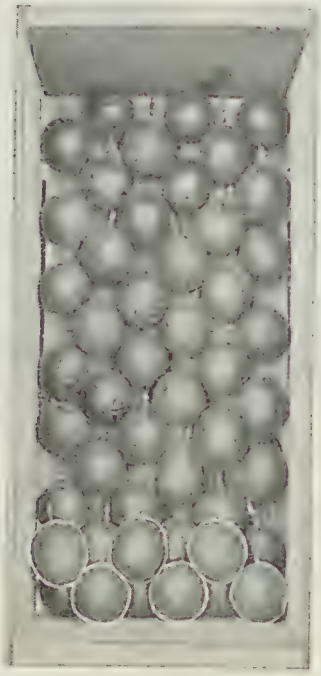


Fig. 6.—Correct method of placing first and second layer of the 3-3 pack in the Half Dump Case.

Fig. 7 —Correct method of placing first and second layer of the 3-2 pack in the Half Dump Case.

THE HALF DUMP CASE.

Those who use the Half Dump Case will find that the 3-3 (three-three) pack will suit practically all sizes, though here again, with the Black Mammoth a variation may be necessary, and the 3-2 (three-two) pack will be found the best for extremely large sizes.

When used in hot districts the Half Dump case should be made with reasonably close-fitting boards. Lining paper is then unnecessary, but a very thin layer of wood-wool at both top and bottom of the case is recommended. This will retard rapid evaporation, and prevent the fruit opening up in a shrivelled condition.

The packing of the Half Dump case is very similar to the Long or Half Long bushel cases just illustrated, except that 3-3 (three-three) packs will be required instead of the 2-2 packs; 3-2 packs may be necessary if the fruit is exceedingly large. Figures 6 and 7 illustrate the method of placing the passion fruit in the Half Dump case so as to form the 3-3 and 3-2 packs.

The correct method of placing the first and second layers of fruit in the different styles of cases is shown in several illustrations. Illustrations are also given showing the correct "layer counts" in the various packs used for most of the commercial sizes of passion-fruit.

Correct Height of Fruit in Cases.

Packing passions to the correct height in the case and the "snugness" of the specimens in each layer are the important features for safe carriage over long distances.

The top layer of passion-fruit should be from three-quarters to one inch above the top in the long bushel case, and from half to three-quarters of an inch in the half cases before the lid is nailed on.

Packages wherein the top layer is just level will be low and arrive slack, while the reverse means damaged fruit.

Branding and Stencilling.

Figure 8 illustrates a suggested method of branding or stencilling.

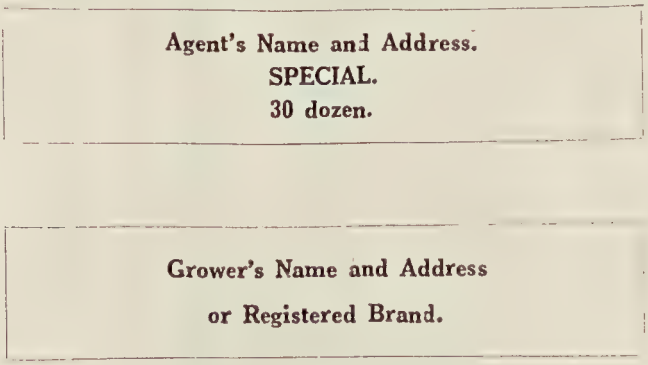


Fig. 8.

Nailing Down, etc.

This is an important operation, as the fruit may be easily damaged. Do not nail down on a hard or uneven floor. Place battens beneath each end of the case, or use a nailing down bench to lessen any severe pressure from the centre of the package. (See Figs. 9 and 10.)

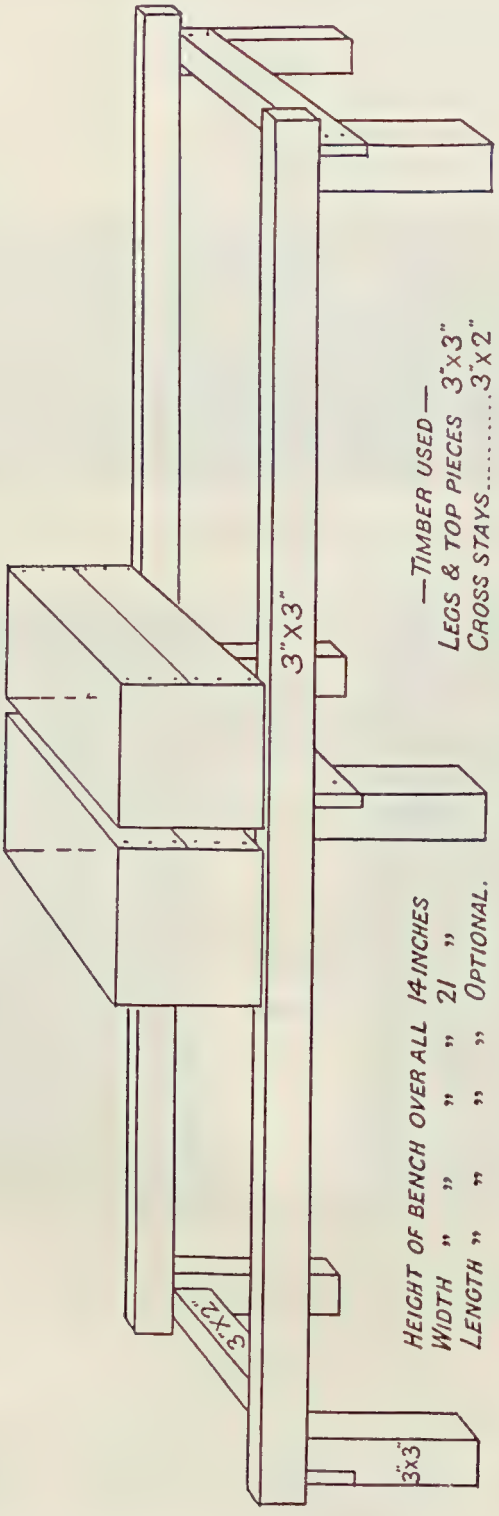


Fig. 9.—A home-made nailing-down bench suitable for the Half Dump Case.

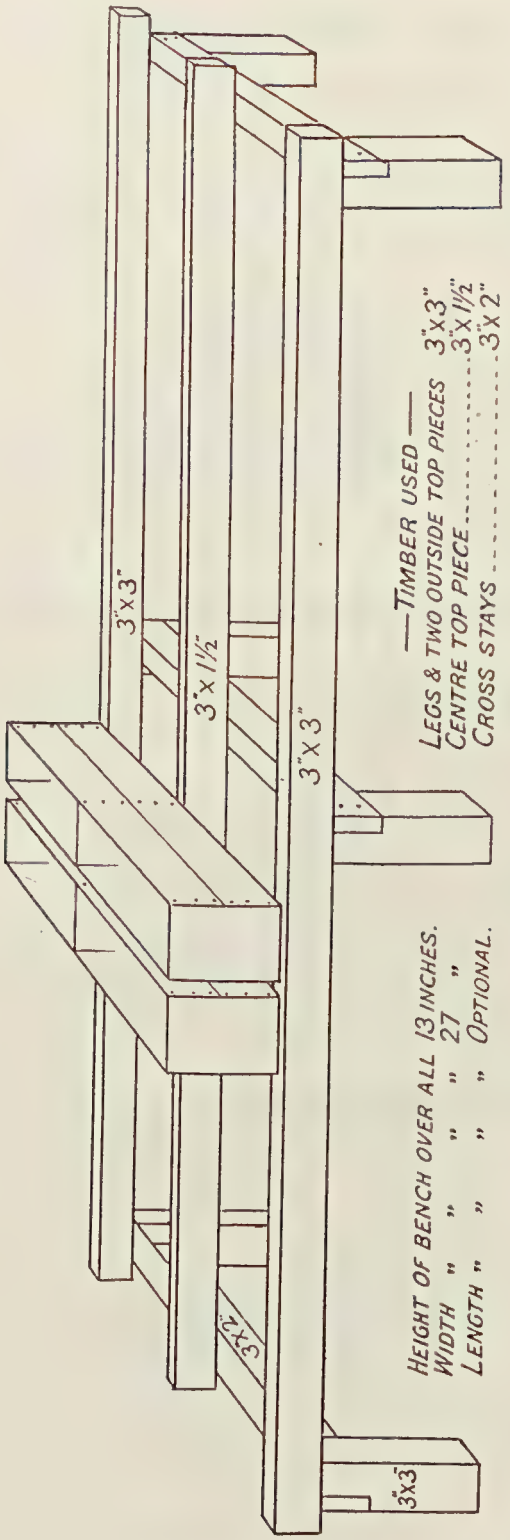


Fig. 10.—A home-made nailing-down bench suitable for the Half Long Bushel Case.

THE PACKING CHARTS.

Long Bushel Case (26 x 6 x 14¼ in.)

Pack.	Layer.	Layers.	Total.
3–2	5 x 5	12	600 or 50 dozen
2–2	7 x 6	10	520 ,, 43 dozen and 4
2–2	6 x 6	10	480 ,, 40 dozen
2–2	6 x 5	10	440 ,, 36 dozen and 8
2–2	5 x 5	10	400 ,, 33 dozen and 4
2–2	5 x 4	10	360 ,, 30 dozen
2–2	4 x 4	10	320 ,, 26 dozen and 8
2–1	6 x 6	8	288 ,, 24 dozen (stalks to centre, otherwise low)
2–1	6 x 5	8	264 ,, 22 dozen (stalks to centre, otherwise low)

Half Long Bushel Case (26 x 6 x 7⅛ in.)

Pack.	Layer.	Layers.	Total.
3–2	5 x 5	6	300 or 25 dozen
2–2	7 x 6	5	260 ,, 21 dozen and 8
2–2	6 x 6	5	240 ,, 20 dozen
2–2	6 x 5	5	220 ,, 18 dozen and 4
2–2	5 x 5	5	200 ,, 16 dozen and 8
2–2	5 x 4	5	180 ,, 15 dozen
2–2	4 x 4	5	160 ,, 13 dozen and 4
2–1	6 x 6	4	144 ,, 12 dozen (stalks to centre, otherwise low)
2–1	6 x 5	4	132 ,, 11 dozen (stalks to centre, otherwise low)

Half Dump Bushel Case (18 x 8⅔ x 7⅛ in.)

Pack.	Layer.	Layers.	Total.
3–3	9 x 8	5	255 or 21 dozen and 3
3–3	8 x 8	5	240 ,, 20 dozen
3–3	8 x 7	5	225 ,, 18 dozen and 9
3–3	7 x 7	5	210 ,, 17 dozen and 6
3–3	7 x 6	5	195 ,, 16 dozen and 3
3–3	6 x 6	5	180 ,, 15 dozen
3–3	6 x 5	5	165 ,, 13 dozen and 9
3–2	7 x 7	4	140 ,, 11 dozen and 8

(*To be continued*).

ROCHESTER IRRIGATED DAIRY FARM COMPETITION, 1928-29.

Report by L. C. Bartels, B.Ag.Sc., Senior Irrigation Officer.

Every exhibit in the Rochester Irrigated Dairy Farm Competition was praiseworthy in some regard, and some were excellent. Twenty-four entries were obtained by the Society, and nineteen entrants carried through with the three inspections made.

A well-balanced scale of points was adopted. This took cognizance of all the main factors making for success on an irrigated farm. Mr. E. Ryland, of the Water Commission, and the writer acted as judges at all inspections; Mr. J. A. Aird assisted at the first inspection.

Mixed pastures have been widely adopted in the Rochester district, particularly in Nanneella, but some growers pin their faith to single crops; for instance one extols lucerne, another subterranean clover, &c., but favour swings with the season. Subterranean clover is good in winter and spring, but in summer, when the clover dies down, lucerne comes into its own. Obviously such crops should not be compared; both are excellent, and both have their place. Unless a restricted water supply makes it necessary, the practice of reserving paddocks for subterranean clover alone is not economical. In the oldest pasture at Werribee subterranean clover dominates everything in September. By December white and strawberry clover and various grasses occupy all the ground.

Those who hold out against mixed pastures object that they require too much water. Undoubtedly frequent watering is necessary, but not excess quantities of water. Of course, on porous ground, where the soil absorbs moisture readily, frequent watering of pasture may lead to waste, whereas, if lucerne is grown, the soil acts as a reservoir for moisture which is tapped easily by the deep roots.

Irrigation farmers are often concerned because their lucerne plots are invaded by other plants, some possessing fodder value, such as grasses and clovers, and some that may be described as aggressive weeds, and naturally the farmer desires to know how he can get rid of these. Others are interested to know how grasses and clovers sown with lucerne will fare in association with the crop.

The relations between lucerne and other plants will depend on conditions and management. Given favorable treatment, lucerne is the dominant partner, and even under unfavorable and dry conditions it will survive when other plants die out. On the other hand, lucerne is very susceptible to the effects of excess moisture, and will be handicapped under wet conditions which favour some grasses and clovers.

Natural conditions include soil and climate. In a deep, well-drained soil, where the roots can go down, lucerne has a great advantage over shallow-rooted plants. It dies out in a humid climate, and may be killed in winter in a cold climate—conditions which do not obtain in the irrigation areas of Victoria.

Management includes methods of irrigation, top-dressing, and the use made of the crop.

Abuses in irrigation may arise through faulty grading—the use of cross-check banks to spread the water, and lack of care in applying water. Lucerne may be killed out and replaced by water-loving plants —millets, paspalums, rushes, &c. A method used effectively by some farmers in the Rochester district in remedying such a condition is to withhold water from lucerne for a season or two.

Top-dressing is the most important factor in ensuring the "cleanliness" of a lucerne stand. This has been very well demonstrated in the departmental manurial tests. Not only will liberal manuring maintain a young lucerne stand in good order, it will also rejuvenate an old stand, and by invigorating the lucerne enable it to smother out undergrowth, and paspalum distichum, paspalum dilatatum, windmill grass (*Chloris truncata*), creeping red mallow, and hoary cress will be kept under control.

Top-dressed lucerne which is allowed to grow up will keep both white and subterranean clover under control. This is very well shown at Werribee, where lucerne has been sown in an old pasture paddock. At first, the white clover made a bid for mastery, but it has since been kept down. It would be difficult to entirely suppress weeds which fill up all the bare spots, and it must be emphasized that lucerne gets its advantage through being encouraged to make tall growth. It withstands cutting, while this handicaps many other plants. The use made of the crop, therefore, has an important bearing. If the lucerne is grazed heavily, it is detrimentally affected, whilst grasses and clovers are favoured. In a pasture mixture, lucerne will gradually die out. It will remain more prominent in a meadow, that is ,a mixture grown for hay, and a lucerne stand used for grazing will be favoured if at maturity it is cut at least once in the season.

Mention may be made of two grasses observed first at Rochester. They are spreading in old lucerne stands, and appear to be readily eaten by stock. These are Plain grass (*Eriochloa punctata*) and Maned panic grass (*Paspalidium jubiliflorum*).

The dairy herds in the Rochester settlements are of good quality, and are being brought to a high standard of productivity through herd testing. Messrs. Keele, Schier, Desmond, Jarvie, and Pierce have Jerseys and grade Jerseys. Mr. Clymo has a herd of Ayrshires.

The district is notable for the advances made in poultry farming and pig raising, two lines of industry which have been fostered to great advantage by Mr. Roy, of the Water Commission. Big flocks of poultry in well-equipped houses were shown by Messrs. Foster, Clymo, Aitken, and Shale.

In the opinion of the judges, Mr. M. Aitken's farm was first in a number of very good exhibits. He has a block of 41 acres at Ballendella. Six acres is in orchard, 5 acres bore a crop of oats last year, and is now fallow, and the remainder of the block is in lucerne of varying quality. The area is divided into nine paddocks, all accessible from a lane. The fencing is particularly good. The layout for irrigation is on right lines, and the channels are kept clean. A shelter belt of gums protects the house; the farm buildings are complete and neat, and the yards are tidy. Pig sties and an up-to-date poultry shed are included. Rain-water from the sheds is saved, and an automatic system supplies the poultry in every pen. Six galvanized iron tanks are used as grain bins.

Mr. Aitken's dairy herd is mixed, but his returns average £20 a cow. He has a pure-bred bull. He joined the Herd Testing Association at its inception, and is culling the poorer members of his herd. He has two crossbred sows and a flock of 200 hens.

Eight acre feet of water per annum is used on the block, but Mr. Aitken has only recently adopted top-dressing, although most of the area received an early autumn dressing of 1 cwt. of super. per acre. Neat stacks of lucerne hay give security for winter feed.

Mr. F. A. Williams has a farm of 67 acres at Bamawm Extension, with a water right of 110 acres. There are eleven paddocks. Nearly 60 acres of this area is in production, 12 acres being under fruit, mainly citrus. There is no pure lucerne, although in one or two paddocks it predominates. Nearly all the paddocks have been sown with rye grass (Perennial, Italian, and Wimmera), with 1 lb. per acre of each of the standard clovers. A feature of the place is the wide-spread development of strawberry clover, and paspalum, which has come uninvited. Although it is regarded as being useful in a mixture, Mr. Williams does not advocate its introduction. The dairy herd numbers 25, and the returns per cow last year average £24. Butter-fat averages for the last three seasons have been 339 lb., 343 lb., and 364 lb. per cow. There are six sows, including two Berkshires and three Yorkshires. A Tamworth boar is used. Returns from pigs last year totalled £275.

The land is pine and box country. Grades are not good, and this defect is aggravated on 20 acres, at least, by the use of contour checks. Half of the pasture on the block is top-dressed each year with 300 to 336 lb. of super. Serviceable farm buildings and ample reserves of hay contributed to the general character of the farm.

Mr. H. A. Schier is spoken of as a successful dairy farmer, and an inspection of his farm shows that good management underlies the reputation he has earned. He has a block of 131 acres. A small portion is low-lying and badly drained. The block is long and narrow. It is divided into seventeen paddocks, most of them opening to a lane through the centre. Mr. Schier has been nine years on the block. He is now milking 35 cows (grade Jerseys), and the average butter-fat production from 33 cows for 1927-28 was 393 lb., equivalent to 434 lb., with allowances for young cows.

A big proportion of the farm is in lucerne, for which the land is particularly suitable. Five acres was sown last autumn to mixed pasture (rye grasses, cocksfoot, and clovers). Mr. Schier says it has been wonderfully productive, but he is biassed towards lucerne. The whole area under permanent crop was top-dressed with one bag of super. per acre. Twenty acres was in oats last year. Mr. Schier buys and fattens store pigs, and has only a small flock of poultry.

Mention must be made of Mr. Pierce, who has a well-managed and productive block of 52 acres at Nanneella. The water right is 1 foot per acre. He has occupied the block for five years, prior to which he was in the Colac district. He bought his cows as heifers, and now has 21 grade Jerseys, with a pure bull at the head of the herd. He is a member of the Herd Testing Association, and his cows averaged 327 lb. of butter-fat. Mr. Pierce mixes grasses and clovers with his lucerne, and does not favour lucerne by itself. One section of 8 acres

Rochester Dairy Farm Competition.

AVERAGE OF POINTS AWARDED BY JUDGES (THREE INSPECTIONS).

Name of Competitor.	General layout of Ground for Irrigation. Facilities for handling Dairy Herd.	Percentage of Land under Cultivation.	Returns from Dairy Herd and appearance of Stock.	Control of Water and State of Irrigation Channels.	Conservation of Fodder.	Poultry and Pigs.	Fences.	Farm Buildings.	Fredom from Weeds.	Care of Implements.	General appearance of immediate Surroundings of Dwelling.	Total.
Maximum Points	**120**	**120**	**90**	**75**	**66**	**66**	**54**	**54**	**45**	**30**	**30**	**750**
Aitken, M. ..	110·5	101·5	73·5	64·5	60·5	53	50·5	54	34·5	24	22·5	649
Williams, F. A.	97·5	105	84	57·5	60	52	51	45	37·5	25·5	24	639
Schier, H. A. ..	103·5	103·5	86	57	63·5	30	42·5	36·5	34·5	16·5	18·5	592
Pierce, J. D. ..	103·5	105	82·5	64·5	51·5	41	41·5	34·5	32·5	14·5	20·5	591·5
Fehring, D. ..	106·5	96	58·5	63	64·5	38	47·5	35	38	16·5	25	588·5
Keele, H. E. ..	94·5	87·5	90	51	50	57	47·5	35	34	20·5	21	588
Hanson, W. H.	106	106	70·5	61	39·5	44	40·5	37	34·5	20	19·5	578·5
Clymo, R. C. ..	102	100·5	82	54	39·5	42·5	43·5	42	34·5	13	24	577·5
Shale, F. J. ..	94	103·5	61	61·5	59	51	34	35·5	36	20·5	18	574
Davis, J. T. ..	91	105	77·5	49	64	25	39	38·5	37	18	24	568
Hann, F. C. ..	93	90	45	62	68·5	48·5	43·5	42	33	19·5	16·5	561·5
Desmond, J. ..	91	88·5	87	46·5	62	37·5	43·5	34·5	33	19·5	15·5	558·5
Foster, H. G. ..	97·5	89·5	52	55	30	61	40	44·5	36·5	18	24	548
Jarvie, D. ..	79·5	59	81	45	41	55·5	31·5	39·5	31	18·5	25	506·5
Gledhill, L. ..	82·5	89	60	38·5	55	43·5	32	34·5	32·5	16·5	22·5	506·5
Watson, E. ..	84	87·5	51	43·5	60	42	28·5	28	33·5	16	21	495
Willman, W. ..	80	81	52	60	56·5	40·5	28·5	27	25·5	16·5	26	493·5
Loader, W. ..	79·5	67	55·5	40·5	40	45	34·5	35	32	16	22	467
Edge, T. ..	80	80	64·5	51·5	29	34·5	32	28·5	26	19·5	15	460·5

of mixed pasture was an outstanding feature. Altogether there are 42 acres of grazing land, divided into eight paddocks. One section, where subterranean clover predominates, was left dry during the summer. One bag of super. per acre was put on last year, and the grasses during the summer are watered every ten days. Pigs have been a good source of revenue to Mr. Pierce, and he netted £64 from the progeny of one sow last year. He has a pure-bred Yorkshire boar, and his sows are crossbred Berkshire and crossbred Tamworth.

Details of awards are on previous page.

POMBORNEIT CALF CLUB.

By P. Hyland, Dairy Supervisor.

Two years ago a Calf Club was formed in the Pomborneit District, and judging by the interest shown at a recent parade and show of calves, the Club will be the means of bringing about a very great improvement in dairy stock and methods of dairying in the district.

Group A—Pomborneit Calf Club, 1927-28.

The club was started by Mr. Cadwallader (Head Teacher of the Pomborneit State School), assisted by a committee representing Pomborneit, Stoneyford, Koallah, Carpendeit, and South Purrumbete Schools. Mr. Greenwood, the District School Inspector, has at all times taken a keen interest in the movement.

All the calves required by the club at its commencement were donated by local breeders, to whom the club owes a great deal of its success. Messrs. Brisbane Bros., Thos. Hose, G. Lucas, and C. Underwood, presented Ayrshires; Messrs. Dave and Keith McGarvie, Jerseys; Mr. F. G. Sadler, Milking Shorthorns; and Mr. McKenzie, Friesians. Members of the Camperdown Traders Association, realizing the worth of the movement, donated a valuable cup as a trophy for the child who bestowed the most care and attention on his calf.

The calves were balloted for by selected scholars from the several schools interested.

Judging is to extend over a period of three years. Points are allotted as shown in the list of awards on page 421. The competition gaining the highest points for any year has the right to hold the cup for a year.

Three inspections are made each year, two on the farm, and the final for the year at the Annual Parade. At the end of three years, the boy or girl obtaining the highest aggregate points will be presented with the cup. This system of judging gives every competitor an equal chance and brings about a very keen competition. Certificates are awarded by the Education Department to all those who successfully rear their calves.

At the time of inspection, the judges submit the competitors to an oral examination on calf rearing, and points are allotted for ability to answer questions satisfactorily. Points are also given for the provision of shelter for both hot and cold weather, and for the provision of fodder.

Group B—Pomborneit Calf Club, 1927-28.

One of the heads under which points are given is a record of the cost of rearing a calf. This proved interesting, and it has been found that the average cost of feeding for the first six months was about £3 16s. If the cost of rearing calves were fully taken into consideration by dairymen, there is no doubt that many scrub calves would not be reared. Hereunder is the statement submitted by Wilfred Betts, winner in group B, of the cost of rearing the calf which has been under his care:—

Milk, new	£2	5	4
Milk, separated ..	0	13	6½
Oats, crushed	0	4	0
Bran	1	1	9
	£4	4	7½

During the year, the club organized a Field Day at Mr. Keith McGarvie's Stud Jersey Farm, "Greenwood," Pomborneit. The schools which formed the club were well represented, and a number of parents and others also attended. Mr. McGarvie, who has a very fine herd of Jerseys, gave a practical demonstration of judging a dairy cow, pointing out the defects as well as the good points to be looked for.

On the occasion of the last parade a judging competition was held for all members of the calf club. A quiet old cow was obtained for the purpose, and Mr. Ron Brisbane, who acted as judge, indicated the various points on which the animal was to be judged. Each competitor was then given a score card, and he allotted points under the several headings. This competition was won by Miss Dorothea Walsh.

The holder of the cup for Group A during 1927-28 was Elizabeth Mathieson. This year it passes to Newton Moore. In Group B the holder of the cup for 1928-29 is Wilfred Betts.

There should be more of these clubs in the dairying districts of the State. The children to whom calves are allotted take a very keen interest in them, and get a really good education in the care and management of stock. Further, the value of good pure-bred stock is gradually brought home to them. A club would also be the means of distributing valuable pure-bred stock among the district herds, and in a few years this must have a good effect. The existence of such a club should also bring about the formation of Herd Testing Associations, for one of the regulations of the Pomborneit Club is that each heifer must be put under test as soon as she comes into profit.

DETAILS OF AWARDS FOR THE YEAR 1928-29.

(Possible Points 150.)

Name of Competitor.	General Appearance, Health, Condition, &c.	Training, Leading, Handling, Grooming, &c.	Record of Cost of Rearing, and Keep.	Improvement of Calf for Year 1928–29.	Points allotted in 1927–28.	Total Points.
GROUP A.						
Newton Moore ..	15	15	6	8	93	137
Muriel Harrison ..	14	15	5	9	84	127
Lennie Tompkinson ..	14	14	6	10	76	120
Vincent Nihill ..	13	14	6	7	78	118
Mary Jackson ..	14	13	10	9	71	117
Elizabeth Mathieson	14	14	6	8	67	109
Dorothea Walsh ..	15	14	8	10	66	113
GROUP B.						
Wilfred Betts ...	13	14	8	8	64	107
Edgar Morrison ..	15	14	10	9	52	100
Lily Anson	9	13	5	5	65	97
William Nihill ..	14	11	6	10	50	91
Ivy Pyke	9	10	8	4	59	90

AVIAN TUBERCULOSIS.

TUBERCULOSIS OF BIRDS.

By R. N. Johnstone, B.V.Sc., Veterinary Officer.

Tuberculosis is a chronic infectious disease affecting man and all domestic animals.

The existence of the disease amongst fowls and other birds has been recognized in Europe during the past 50 years. Occasional outbreaks are met with in this State, and while there is at present no means of arriving at an accurate estimate of the annual loss caused, the possibility exists that, if the disease were more readily recognizable, a far greater number of outbreaks would be reported. Once tuberculosis makes its appearance in a flock, although a great number of birds may not die at one time, the general unthriftiness of the fowls, which renders them unfit for table use, and decreased egg production make the industry unprofitable and discouraging to the poultry farmer.

Cause.

The disease is due to the bacillus *Tuberculosis avium*. Although this organism differs slightly on cultures in artificial media, and in its effects on experimental animals, from those which cause tuberculosis in man or animals, it has the same staining characteristics; morphologically they are identical, and the avian type of bacillus has been isolated from many tuberculous pigs, and in several instances from human beings. During recent years the occurrence, in the United States of America, of tuberculosis amongst pigs reared on farms on which all cattle were free from this disease caused grave concern, but careful investigations have disclosed the fact that the infective organism was of the avian type, and that infection had been derived from tuberculous fowls on the farm.

If the carcasses of fowls that have died of tuberculosis be fed to pigs they may become infected with the disease. There is also a liability where fowls have access to the pig-run that the disease may be communicated to pigs through the birds' droppings.

The avian bacillus is very resistant to outside influences, such as heat, sunlight, and disinfectants.

Mode of Infection.

Natural infection of healthy fowls is brought about by their eating food which has become contaminated with the droppings of infected birds. When intestinal ulcers are present, such droppings contain enormous masses of bacilli. Infection may also be brought about by permitting fowls to have access to the carcasses of birds which have died from the disease. Further, the disease may be introduced with infected eggs, the whites of which contain virulent bacilli.

Symptoms.

Having gained entrance to the body the organism chooses a favorable location in which to multiply, and lesions are set up in the intestines, in the liver and spleen, in the lungs, or in the bones and joints

As the disease progresses, the bird loses condition, although the appetite may, for some time, remain unimpaired. On examination, it will be found that the flesh has almost entirely disappeared from the breast bone. Later on, the bird will become anæmic, and paleness of the membranes of the mouth and of the wattles and comb will be more and more pronounced. The appetite will be affected, the birds will become listless, and may be easily captured. Finally acute yellow or greenish diarrhœa develops with resultant complete exhaustion and death. This stage of the disease is most dangerous to the remainder of the birds, for then the droppings contain large numbers of bacilli.

Tuberculosis of the bones and joints is very common. The knee and shoulder joints are most frequently affected. The joints swell, the ends of the bones become enlarged, and the animal shows lameness. This is frequently the only symptom noticed in the early stages, and mention of it in letters requesting advice leads one to suspect the presence of this disease.

Although some fowls affected with tuberculosis may die a few days after the first appearance of symptoms, as a general rule they linger for weeks, becoming gradually more anæmic and emaciated, until death finally occurs from complete exhaustion. Some outbreaks follow a more rapid course than others, depending generally on the housing conditions, the general health and resistance of the birds, and the system of management adopted.

Diagnosis.

Diagnosis in the living fowl is particularly difficult. No symptom or group of symptoms can be considered as characteristic of the disease. The tuberculin test is not applicable because tuberculous fowls will not give specific reactions to tuberculin. Although a description of symptoms may give rise to suspicion, the disease can be positively identified only by post-mortem examination.

Post-Mortem Appearance.

The liver and spleen are most frequently affected. Irregular nodules, varying in size from a pinhead to a pea, and sometimes larger, are found in the substances of these glands. The contents of these nodules are white or yellow in colour; sometimes they are easily broken down; occasionally they become calcified and feel gritty when cut. The lesions are distinct from the surrounding tissue, from which they may be separated easily; they are surrounded or enclosed by a connective tissue capsule. In rare cases, lesions are seen as minute grey or yellow points, sometimes scattered singly through the substance of the gland, or gathered together in groups. The diseased gland, especially in chronic cases, is considerably enlarged and friable. The liver may be twice its normal size and the spleen four times. The intestines may or may not be involved. When lesions are present the inner (digestive) surface will be covered with small yellowish nodules, and ulcers may be present. On the outer (serous) surface, nodules varying in size from a pea to a hazel nut will be firmly attached. Usually these nodules communicate with the inner surface of the bowel through a fistulous canal, and by this means large numbers of bacilli gain entrance to the bowel, and are distributed in the droppings. The interior of the small nodules is greyish-yellow in colour, and is tough; the larger ones may contain cheesy

areas, or may consist wholly of a yellowish crumbly substance. The lungs are sometimes affected, and contain nodules resembling those found in the liver. In the joints, which are commonly affected, the cavities are found filled with a cheesy mass; the ends of the bones show erosions —i.e., they are roughened. Cheesy areas may also be found in the shafts of the bones.

Prevention.

Medicinal treatment is of no value; therefore preventive measures must be adopted. Because of the insidious nature of the disease, and difficulties in diagnosis, isolation of all affected animals is not possible; therefore, the most practical and economical method of procedure is to slaughter the whole flock as soon as the disease is recognized. Animals in good flesh may be used for food if, on examination, the liver or spleen shows no white or yellow spots (these usually are from the size of a pin point to that of a pea or larger), and provided there are no nodules or lumps on the intestines. When lesions are present the flesh cannot be considered suitable for food.

The poultry yard as well as the houses and coops should be thoroughly cleaned and disinfected before fresh stock is acquired. Disinfection is necessary because of the fact, already shown, that the bacilli are found in the droppings in great numbers. For this reason every effort should be made to destroy the droppings.

THE PROPER METHOD OF DISINFECTING FOWLHOUSES.

1. Remove all litter from floors, nesting places, and yards, and to avoid contamination of the surrounding soil, burn the rubbish as near the building as possible.

2. The contents of all hoppers, feed bins, and troughs, such as dry mash or other food or grit, should be burnt with the litter. Scald all utensils, pans, &c., using steam, if possible.

3. Remove all nests, moveable roosts, windows, and portable fixtures from buildings; thoroughly wash with warm water and soap, to which disinfectant has been added, and place in the sunlight.

4. Thoroughly sweep down the inside of buildings so as to remove all dirt, cobwebs, &c., or, if possible, flush them out with a hose. All accumulations of hard droppings should be softened with water and scraped off with a sharp instrument.

Disinfection may now be commenced. Thoroughly spray all buildings, fences, yards, and appliances with a 5 per cent. solution of lysol. Sunlight is the best of all disinfectants, and its free access to all buildings, &c., should be allowed where possible.

Slake some fresh quicklime by adding boiling water (when heat ceases the lime is slaked). Thin to the consistency of milk with boiling water, to which has been added 1 oz. of alum, 1 oz. of powdered glue previously dissolved in hot water, and 4 oz. of lysol for each gallon of completed wash, and strain through two thicknesses of cheese cloth. The easiest method of applying lime wash is by means of a spray pump which can be purchased at a reasonable cost, and can be used for other purposes. In the absence of a spray pump, a whitewash brush may be used, although it is difficult to fill the cracks and crevices without a

stream to drive in the solution. These cracks serve as breeding places for ticks, lice, &c., and should be given careful attention. Where an infectious disease such as tuberculosis is present, it is wise to spray the interior at least twice, with an interval of one week between each application. The runs should be covered with quicklime, and the surface ploughed up or dug. They should be divided and changed each year, one half being used for rape or other green crop. If portable houses are in use, they should be moved frequently, as feeding fowls on the same ground year after year serves to infect them with numerous diseases. Disinfect in the spring and autumn each year, if possible, and by all means before introducing fresh stock.

LIP AND LEG ULCERATION OF SHEEP.

LIP AND LEG DISEASE.

By R. J. de Courcy Talbot, B.V.Sc., Veterinary Officer.

This disease occurs in Victoria from time to time, but only occasionally does it assume the character of a severe epidemic, as sometimes happens in the United States of America and Europe. The last outbreak of any consequence in this State brought under official notice was that which occurred in 1925 in the Rutherglen and Wahgunyah districts, when a considerable number of sheep and lambs were affected.

As the name suggests, the disease is characterized by the formation of purulent ulcers, which afterwards form into scaly crusts or scabs in the region of the lips, the nose, and around the coronets. These parts may be affected either together or separately.

Lambs and sheep under the age of twelve months are most commonly attacked, but animals of all ages are susceptible, and in severe outbreaks practically the whole flock may suffer.

In mild cases the disease readily responds to suitable treatment, but if neglected some mortality will probably ensue. Death may be due to starvation which results from the animal's mouth being so ulcerated that it cannot eat; or it may be that the lesions in the leg cause a lameness so acute that the animal is unable to walk.

Cause.

The disease is contagious, and is caused by a germ, the *necrosis bacillus*, which gains entrance into the tissues of the lips or coronets of young animals by way of slight wounds or abrasions of the skin caused while walking among or feeding on rough dry grass or thistles.

The causative organism may be present in a paddock for many years, but only when conditions are favorable will any of the sheep become affected. In this connexion it is interesting to note that the most severe outbreaks which have come under notice have occurred during the winter or late spring of a year in which there was an abundance of old dry feed.

Symptoms.

The ulcerations are most commonly found on the nostrils, lips, and coronets, and in simple cases the first lesions noted are a number of small pustules about the size of a pea. These become larger until they break, and the pus exudes; this dries and forms a crust or scab which has a warty dry appearance, and if it be lifted the tissues underneath will be found to be very much inflamed and ulcerated.

The complaint appears very quickly, and unless precautions are taken to isolate the affected members of the flock it will spread rapidly until a large number contract the disease. In some cases the ulcers are found on the membranes inside the mouth, and sheep so affected rapidly fall away in condition.

The ulcers on the coronet are similar to those on the lips and nose, but are usually more severe. Both fore and hind legs may be affected, the front and sides just above the hoof being the commonest seat of the trouble. In chronic or neglected cases the inflammatory processes may spread to the tissues inside the hoof and cause acute lameness; sometimes the claws drop off.

When a lamb still sucking has the ulcers on its lips it may carry the infection to the ewe's udder, which then develops a similar ulcerated condition.

Treatment.

If early treatment is adopted a complete cure is certain. It is important to remember that the disease is contagious, and all affected animals should be isolated, and if they have been recently through a shearing shed or yards these should be disinfected by being sprayed with a solution of sheep dip or some such disinfectant.

The germ which causes the disease cannot live in the presence of air, and it is therefore necessary in all treatments to remove the scabs from the ulcers and expose the inflamed surface.

In mild cases the affected parts should be washed with 1 per cent. solution of lysol (one tablespoonful to 2 pints of water), and the scab removed; then apply either an ointment made up of cresol or some similar preparation 5 parts, sulphur 10 parts, and vaseline or lard 10 parts. If an oily dressing be preferred, apply the following mixture:—Creosote 1 part, turpentine 3 parts, linseed oil 6 parts. This treatment should be repeated three or four times a week, and in mild cases a cure is usually effected in this time.

In severe cases, after the scabs have been removed by bathing them with an antiseptic solution and the ulcers appear to be deep and are discharging a foul-smelling pus, the inflamed surfaces should be painted with a strong tincture of iodine, and afterwards dusted with a powder made of equal parts of boracic acid and chloride of lime. This treatment should be repeated as often as possible.

Animals which have been affected should not be allowed to rejoin the flock until at least a fortnight after their recovery.

As with other contagious diseases, a paddock in which an outbreak has occurred should not be restocked until it has either been cultivated or burnt.

MEALY BUG.

(*Dactylopius longispinus.*)

A POTENTIAL VINE PEST.

By F. de Castella, Viticulturist, and C. French, jun., Entomologist.

Though unnecessary scares are, to say the least, undesirable, it would be unwise to ignore the menace of a recent development in the Mildura district, where a rather common garden insect has been found to attack vines, and damage their fruit. In the absence of proper control this might become a serious vine pest, and it is deemed advisable to warn vine-growers of the danger so that infection may be located and suppressed in good time.

In February last, a vine-grower of Nicholl's Point, near Mildura, complained that an insect, new to him, had damaged some of his grapes during the past few years, and that, in the season recently closed, it was much more plentiful than previously. Specimens sent to Melbourne proved this to be a "mealy bug." It was identified by one of us as *Dactylopius longispinus* (Targioni.) *syn. D. Adonidum* (Signaret) and *Pseudococcus longispinus* (Targ.), a widely distributed pest, especially in glass houses, and which is often found in Melbourne suburban gardens.

Mealy Bug in Other Countries.

Mealy bug as a vine pest is not a novelty. In France, two distinct insects of this group attack the vine, viz., *Dactylopius vitis* and *Pulvinaria vitis*,* the sooty fumagine fungus that accompanies them living on their sugary exudations, being more objectionable than the insects themselves. *D. vitis* is, however, distinct from the insect that concerns us at present.

It has been observed that fumagine is most prevalent in dry years; a wet season usually causes it to disappear altogether. Hence it is to be feared that the dry climate of the Murray Valley will suit *Dactylopius* only too well. In Palestine, *D. vitis* is responsible for what is known as the Jaffa disease. In symbiotic association with a fungus, *Bornetina corium*, it constitutes the vine root disease studied by Viala under the name of *Phtiriose*, which has caused the death of vines in Tunis.

In Californian vineyards, trouble has been caused occasionally by a mealy bug, known there as *Pseudococcus longispinus*, identical with *D. Longispinus*, which has been found on Emperors, Malagas, and Thompson's seedless (Sultana). According to Fred. P. Roullard†—"It is noticed as a pest on the grape more, perhaps, than on any other plant. Honeydew on the grape berries is a sure evidence of the presence of the mealy bug, and by close observation a small grey insect can be found on a leaf stem, or in among the berries."

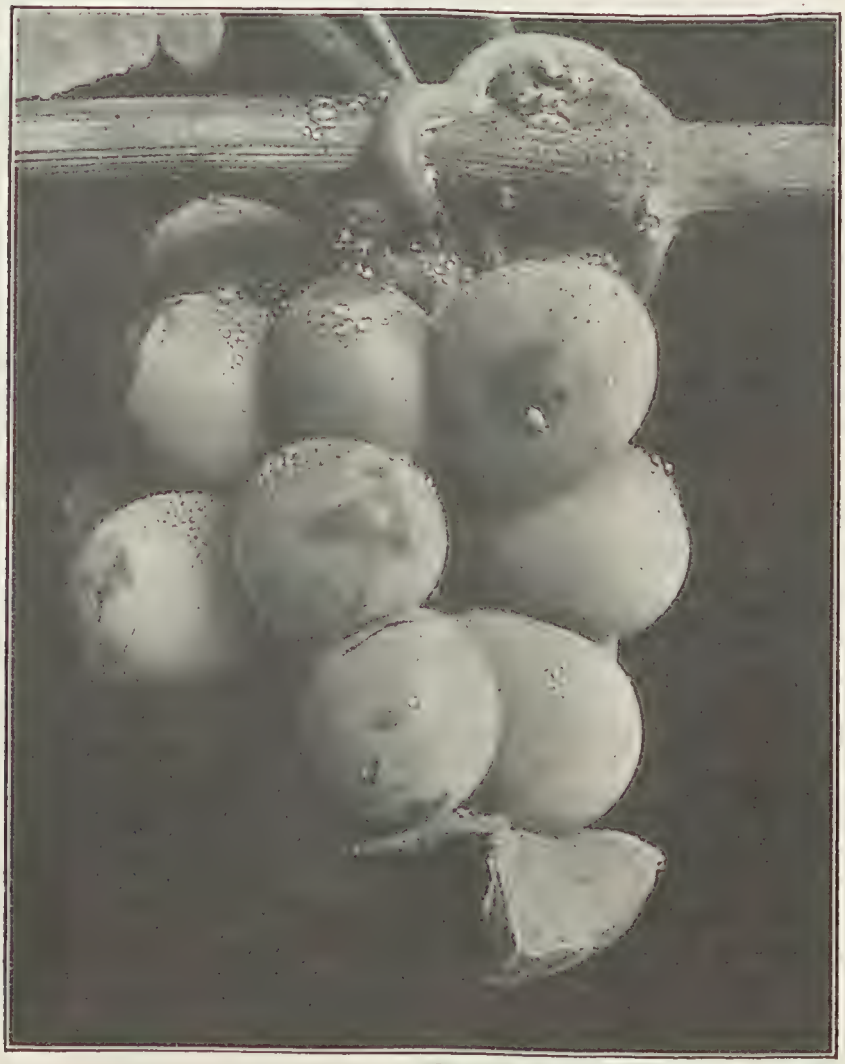
Fig. 1 is reproduced from a photo given by Mr. Roullard to Mr. J. M. Ward, Superintendent of Horticulture, when he visited California in 1918. It was then considered "probable that a control may be accomplished by the Philippine ladybird beetle, a natural enemy of the mealy bug. . . . Cleaning the stump of the grape vine of its outside dry scaly bark, and spraying with a 10 per cent. coal oil emulsion after pruning will also help in ridding the pest, as it hibernates in the winter in the crevices and cracks of the vine."

* Pulvinaria is not a true Mealy bug, but is closely allied.

† Insect pests and diseases of interest to horticulturists of Fresno County—By Fred P. Roullard, County Commissioner of Horticulture, 1915.

In South Africa likewise, according to Professor A. I. Perold,* a mealy bug named *Pseudococcus capensis* is found in Cape vineyards.

One usually sees individual ones crawling about from berry to berry when the grapes are about to turn colour. Later on, one notices the white masses, hence the name *mealy* bug, in the bunches. They remain in one place. It would be better not to have this bug on wine grapes. It completely spoils table grapes,



[Photo. kindly supplied by Mr. Fred P. Roullard.

Mealy Bug in California—on "Malaga" Grapes (identical with our "Valensy").
Note the characteristic honey dew which later dries to a white sugary mass.

and this is where it does most damage. It seems to be getting gradually worse in our Cape vineyards. According to my own observations on the Paarl Experiment Station, it seems to be worse on vines that grow vigorously and form big compact bunches like Grenache Noir. When ants run about on a vine, it is usually a sure indication of the presence of the mealy bug."

For control, fumigation with hydrocyanic acid is suggested; also to spray with hot water (158° F.), and, from the time the bugs appear on the bunches, to cleanse. *

* *A Treatise on Viticulture*—Macmillan and Co., p. 496.

Mealy Bug on Other Plants.

Dactylopius longispinus attacks ferns, orchids, coleus, dracenas, gladioli, citrus, mango, guava, fig, grape, plum, cycads, zamia, oleander, croton, &c. Another closely allied species, *D. affinis* (Maskell) is subterranean. The roots of attacked plants are conspicuous by the felted white mass, which often completely covers them. When the roots are badly attacked, they often split, and the bark peels off, causing the plants to die. In some districts, mealy bugs are particularly destructive to carnations. The roots of asters, dahlias, and vines, and the corms of gladioli are also attacked by *D. affinis*.

These insects are on the increase in gardens in the Melbourne suburbs, where they are responsible for a fair amount of damage to garden plants and vegetables.

The Insect at Mildura.

The vineyard where the trouble occurred was visited in May. The owner first noticed the insect four or five years ago on some vines near the homestead, but as only a few bunches were affected, little importance was attached to it. The proximity of this first outbreak to the garden would indicate that it had spread from some ornamental plants to the vines. The great increase in its spread, especially during the recent vintage, is viewed with alarm by the proprietor, who intends to apply control measures during this winter. The insect has now spread through the whole vineyard. Sultana, zante, currant, and table grapes seem to be equally liable to attack. Fortunately, it is only odd vines, or small patches of vines, that are affected; the great bulk are clean. These affected vines are to be met with irregularly here and there right through the vineyard, which is of fair size, but, so far, no complaints of similar trouble have been received from any neighbouring blocks. It is curious that infested vines are not now more numerous in the part first attacked than elsewhere in the vineyard. It would appear that some natural control is keeping it, at least partially, in check. The damage done to the vintage as a whole was insignificant. Whole loads of grapes came to the dip without any affected bunches, but in some loads an odd dip tin contained faulty fruit. After dipping and drying, affected bunches had a whitish appearance, easily mistaken for mould on the grapes.

The appearance of the worst affected bunches gives an idea of the grave damage that would result from widespread infection such as might easily occur in case of a weakening of the agency serving as a natural control. Such bunches are juicy and sticky with honey-dew (see Fig. 1), which dries to a sugary substance with a whitish mouldy-looking mass intermixed, the latter consisting of the mealy or waxy exudation, and portions of dead insects. Though there is sometimes a little black fumagine fungus, it is more often absent altogether. Affected table grapes are repulsive and unmarketable, whilst dried grapes are similarly damaged, and show a mouldy appearance. Near an affected bunch insects abound, chiefly on the underside of the leaves, lying flat against the larger veins, so that they are scarcely noticeable. On the affected leaves, &c., a good many minute eggs, on long hair-like stalks, were found. These are eggs of lace wings, which may possiby be parasitic on the scale, and the natural agency keeping it in check.

Mealy bugs were also fairly numerous under the old bark on the main stem and arms of the vine near an affected bunch. A search under the

old bark, beneath the soil surface, gave negative results, which is fortunate, as underground overwintering would much complicate control.

Further investigation is desirable on this point.

LIFE HISTORY.

The mealy bugs belong to the order *Hemiptera*, sub-order *Homoptera*, and group *Coccidcae*. They are thus scale insects, though they differ from many familiar scales in retaining liberty of motion throughout their lives. They do not become fixed to the host plant like the orange, San Jose, and several other scales. *Dactylopius longispinus* is illustrated in Fig. 2, which is magnified about ten times. It is a soft insect of a characteristic and easily recognized shape with numerous spines or processes round its edge, and a few very long anal spines, to which it owes its specific name. Though really of a light pink colour, this is almost hidden by the mealy exudation or powder that covers it, and gives it a greyish white, almost silvery appearance, practically waterproofing it, and protecting it from spray liquids to no small extent.

Mealy Bug (*Dactylopius longispinus*).
(Magnified about 10 times.)
Two females in different stages of development.
[After Collinge.

It is indigenous to Europe, where it has long been known, particularly in glass houses. It has become widely disseminated in gardens throughout the world.

According to American entomologists it does not lay eggs—the young are born alive. There are several generations each year; in fact, breeding extends practically throughout the entire year. The life cycle occupies about two months. In Fresno County, California, according to Roullard, owing to climatic conditions, there is very likely but one cycle a season. Male insects are scarce; as is the case with many lower insects, reproduction is largely parthenogenetic.* As the females never assume a winged form, dissemination must be mainly due to the agency of birds and other insects which carry minute young scales from vine to vine.

* Parthenogenesis is reproduction without sexual union.

Control.

This can best be effected by spraying with a contact insecticide, capable of destroying any insects it touches. It should be of a soapy nature in view of the waterproof mealy coating.

During the growing season, nicotine sulphate, 1 oz. to 5 gallons of water, in which some soap has been dissolved, will give good results.

In winter time, stronger insecticides can be used without injury to the dormant vine, and it is at this season that the insect can most effectually be dealt with. Several insecticide solutions may be used. Before the application of any one of them, ploughing away from the vines, followed by hoeing out the strip, between the vines in the row, is strongly recommended. The base or butt of the vine trunk is thus exposed, and the destruction is assured of any insects which might hibernate at a shallow depth beneath the soil surface.

Treatment of the whole of a block of vines may not prove necessary. The patchy nature of infestation has been mentioned already. It may suffice to treat affected patches, with a safety zone around them, three or four vines in depth. Such patches should be carefully located at vintage time when the mealy bugs are in evidence on the grapes, and the vines marked on the trunk with paint or whitewash.

The Acid Iron Sulphate Swab.

The acid iron sulphate swab, as used against anthracnose or vine black spot, is held, in France, to effectually clear vines of *Dactylopius* and *Pulvinaria*. It is worth noting that though the Mildura vineyard where the insect was recently found had been regularly swabbed, to protect it from black spot, some years back, no swabbing had been executed for five or six years. This swab is so well known that we need only here recall that the usual formula is iron sulphate 20 lb., sulphuric acid 8 lb., water 10 gallons. It can be applied with whitewash brush, mop or spray pump of special type. Being very corrosive, it would soon ruin an ordinary spray pump.* As the swab is the standard winter treatment for anthracnose, its application would serve a dual purpose. Seeing that the insect hides under the old bark, this should either be removed, or sufficient solution used to thoroughly wet through it.

Viala (France) recommends early pruning of affected vines, soon after vintage, followed by a thorough swabbing with the acid iron sulphate solution and a repetition of this swab at the end of winter, shortly before the vines sprout.

Balbiani's Mixture.

Winter treatment with this mixture has recently been recommended for the control of vine Pulvinaria in France. Devised many years ago for the treatment of Phylloxera by the destruction of the winter egg, a method which, for other reasons, proved ineffectual, it is, nevertheless, a very powerful insecticide. Two somewhat different formulae given for it by Viala and Foex respectively are as follow:—

	Foex.	Viala.
Heavy oil of tar†	20 parts ...	20 parts
Crude naphthaline	60 ,, ...	30 ,,
Quick lime	120 ,, ...	100 ,,
Water	400 ,, ...	400 ,,

* For further particulars see Bulletin No. 42, "Anthracnose or Black Spot of the Vine," obtainable free on application to the Department of Agriculture.

† This seems to be much the same as coal tar distillate, which is obtainable in Melbourne.

The naphthaline is first dissolved in the oil of tar. The quick lime is next slaked with just enough of the water to fuse it thoroughly. Whilst it is very hot the oil-naphthaline solution is poured on it in small quantities at a time, and well mixed. Further small additions of water are gradually made, with constant stirring, until a smooth cream-like mass is obtained. To this the rest of the water is added, and the mixture is ready for use.

Though more costly than acid iron sulphate solution, and more troublesome to prepare, this is a powerful insecticide which is less known than it deserves. Its efficacy against mealy bug receives support from the Californian recommendation of a 10 per cent. coal oil emulsion spray (p. 427). Before applying it to the vine, the removal of the rough outer bark, in the greatest measure possible, is strongly recommended.

Lime-Tar Mixture.

Professor Ravaz has recently recommended,* for the destruction of southern French mealy bugs, the following mixture:—

Lime	8 lb.
Coal tar or heavy oil ...	4 lb.
Water	10 gallons

A thick milk of lime is first made; into this is poured progressively the tar or heavy oil, in small quantities at a time, with thorough stirring, which is continued until the mixture is smooth and even, when the rest of the water is added.

He points out that some growers increase the proportion of lime; some even apply lime alone. Since it becomes carbonated rapidly, its action can be but of short duration.

Lysol in the form of a 4 per cent. spray is also suggested by Ravaz, who points out that this spray has proved very effective in Switzerland against Phylloxera wintering under the bark. Phenyle would no doubt act similarly.

Oil-Phenyle-Nicotine.—This spray, recommended against the Rutherglen bug, should also prove effective, but for winter use the proportion of phenyle could with advantage be increased. The following formula is suggested:—

Miscible oil	½ gallon
Nicotine sulphate	¾ pint
Phenyle	1 gallon
Soap	1 lb.
Water	80 gallons

Red Oil and Nicotine Sprays.

The spray recommended for the woolly aphis of the apple should also prove suitable. The formula is as follows:—

Red oil (or Miscible oil) ...	1 gallon
Nicotine sulphate	1 pint
Soap	1 lb.
Water	80 gallons

Boil the soap in a gallon of water until dissolved; add 1 gallon of red oil, and mix thoroughly; then add 1 pint of nicotine sulphate, and after mixing the whole for a few minutes, add 80 gallons of water. If the water is hard, a small piece of washing soda should be added.

* Progrès Agricole, 13th January, 1929.

Before applying this spray, stripping of the rough outer bark is recommended.

Fumigation with hydrocyanic acid gas would no doubt prove an ideal means of destruction, but its high cost, in view of the large number of vines to the acre, makes it impracticable.

. . . . . .

In conclusion, we would express the hope that the placing on record of this recent addition to the list of our vine insect enemies may cause a sharp look out to be kept for its further spread.

The warm climate of the Murray Valley seem quite favorable, so that serious damage may be anticipated once the insect "gets into its stride," as it may do if no steps are taken to prevent it.

The example of the Cape and California show that the risk of serious trouble cannot be ignored.

It will not do to trust to natural control, whatever it may be, again obtaining the mastery. Positive steps are necessary, and wherever the pest has established itself these are imperative.

Swabbing against black spot is a routine practice in many sultana vineyards. Its application wherever mealy bug has been observed is thus very desirable. Some of the other treatments mentioned above could with advantage be comparatively tried on some rows in the vineyard, more particularly the red oil and nicotine spray.

ORCHARD HYGIENE.

By H. W. Davey, Chief Orchard Supervisor.

The necessity for practising what is known as orchard hygiene for the effectual control of orchard diseases is becoming increasingly apparent.

At this time of the year much can be done towards the control of pests, both insect and fungoid, by means of a general clean up.

The following are just a few necessary jobs if control over the many pests that orchardists are afflicted with is to be attained:—

1. The cleaning up of the packing shed.
2. The destruction of all useless fruit, whether it is hanging on trees or has fallen to the ground.
3. The cleansing of props that have been used for supporting limbs of heavily laden trees.
4. The overhaul of old fruit cases.
5. Attention to headlands of orchards.
6. Cleaning and stopping all hollows in trees.
7. Removing loose bark and fractured limbs.
8. Inspecting outlets of tile drains.
9. The turning under of all leaves in the orchard at autumn cultivation.
10. Attention to uncultivated squares or strips under trees.

The Cleaning Up of the Packing Shed.

Most apple growers are aware that trees close to the packing shed are more severely attacked by codling caterpillars than are those growing some distance away.

The explanation of this is that caterpillars are carried along with the fruit into the shed. These leave the fruit, and pupate in the vicinity, and later emerge as moths, and deposit their eggs on the nearest tree.

The reason why the moths select the nearest trees is that no insect can distinguish stationary objects at any great distance. In fact, it is supposed that no insects can perceive stationary objects at a greater distance than about 6 feet. Some insects of a predatory nature, such as some flies, and also dragon flies, may perhaps see moving objects at a greater distance. But in most cases insects are guided to their food or host plant by smell. It is for this reason that the codling caterpillars, after metamorphosing in the fruit house or packing shed, usually attack trees in the immediate vicinity, for the scent from these trees would be more perceptible to the moths than that from the trees growing farther away.

It is, therefore, important that a packing house, no matter whether used for fresh fruits or dried fruits, should be kept thoroughly clean and free from debris of any kind. Also, that apple and pear trees in the vicinity of packing or drying sheds should receive special attention at spraying times.

The Destruction of all Useless Fruit.

I have on other occasions stressed the necessity for gathering and destroying "mummy" fruits remaining on the trees. Many of these "mummies" carry millions of spores of the disease known as brown rot, that most destructive disease of stone fruits, and if the fruits are left hanging on the trees the spores will be blown about by the wind, or carried to other trees on the feet of birds and insects, and thus the disease will be spread over wide areas.

The gathering up of fallen fruit should never be neglected. Such fruits, apart from helping to carry over the more common orchard diseases, are preyed upon by insects, and this leads to a great increase in their numbers, for it must be remembered that every living thing is controlled by its food supply. Thus, when food in the form of decaying fruit is abundant, those insects whose feed it is will thrive, and some of them, such as fruit beetles for instance, will breed in prodigious numbers, and when they have consumed the major portion of the old fruit they will turn their attention to that hanging on the trees.

The most common of these beetles, usually known as fruit beetles, belong to the genus *Carpophilus* of the family *Nitidulidae*. During the past season I received complaints about this beetle attacking sound figs on the trees, and so occasioning very serious losses to the orchardist.

It can, therefore, be seen that orchard hygiene in the collecting and destroying all fallen fruit is of much greater importance than many growers appear to realize, judging by the quantities of fallen fruits that can sometimes be seen lying about beneath the trees.

Cleaning Props.

In the first place, props should always be barked before being used in the orchard, otherwise the bark, as it becomes loose, acts as a sanctuary for codling caterpillars and egg clusters of the red spider, as well as for some other undesirables.

At the end of the season props should be stacked away, and while being stacked should be thoroughly sprayed with red oil, 1 in 15, so as to destroy eggs of the spider.

Since the introduction of *Aphelinus mali* for the control of the woolly aphis, spraying with red oil has become unnecessary, with the result that the red spider has greatly increased in numbers. The explanation is that, when oils were used to combat the aphis, the spider was also killed by the same spray.

In cases where, owing to red spider infestation, it now becomes necessary to spray apple trees on which the *Aphelinus* is well established, it would be advisable first of all to prune the trees which are to be sprayed with oils or other insecticides. The best of the parasitized shoots should be selected and planted out in nursery rows. In this way the twigs will be kept fresh, and the wholesale destruction of parasitized aphis will be guarded against. The wasps on emerging will fly back to any woolly aphis infested trees, and take up their useful work during next spring.

Apple trees of the Delicious and London Pippin varieties, although not favoured by the woolly aphis, are especially subject to attack from red spider.

Attention to Fruit Cases.

In many instances cases may be seen thrown carelessly into heaps, often under pine trees, where they become stained and full of pine needles.

The overhauling of fruit cases and the repairing of those requiring attention should be carried out some time previous to the rush periods of the fruit season. Dipping secondhand cases in boiling water to which bluestone has been added at the rate of 1 lb. to every 100 gallons of water is hygienic, and would also greatly lessen the risks of infection from transit rot.

Cleaning up Headlands.

The cleaning up of headlands, channel banks, and other weed-infested spots in the orchard is a task that is frequently neglected. Yet it is such spots that the Rutherglen bug and cutworms of different species use as a base from which to emerge later on in the season.

If any person takes the trouble to carefully inspect any such place, especially one where a lot of weeds are growing amongst old and decaying vegetation, he will be surprised at the large numbers of creatures that harbour there. Such spots are an especial menace to tomato-growers, for besides sheltering the tomato moth, it is in places like these that the tomato weevil over-winters, ready to sally forth at the proper time.

Removing Loose Bark, Dead Limbs, etc.

The necessity for removing loose bark from apple and pear trees is known to all fruit-growers, yet many fail to carry out this important work, possibly in some instances because they do not properly realize its full value towards codling control. Loose bark, on apple trees especially, should be removed, because, apart from its attraction to hibernating caterpillars, it is also favoured by red spider, and in the more southern and coastal districts mussel scales (*Mytilaspis*) are sheltered beneath it during the winter months. Spraying material cannot reach all parts of the trunk of a tree unless all the loose bark be removed.

In many of the older orchards there will sometimes be seen trees requiring surgical attention, which if given would mean a new lease of

usefulness and profit. Hollows will often be found in limbs of trees that have been top-grafted, and where the scions have failed to properly cover the wound on the stock.

If a cleft graft is used on a large limb, the scions often fail to cover the split made in the stock, and unless this be filled up or otherwise treated, decay may develop and hollowness will follow.

Strap grafts are favoured by many growers as being more successful in covering large wounds with less attention; but in any case, when large wounds are made on a tree these should be immediately smoothed over with a sharp instrument, and afterwards painted over to prevent water or wood-destroying organisms obtaining an entry, and so causing decay.

Where hollows are already present in pear or apple trees, these make ideal places for hibernating codling caterpillars, and it can easily be understood that bandaging a tree having hollows or spouts is a useless proceeding. Where possible, these spouts should be cut entirely away and burnt; if they are of long standing it will usually be found that the decay has extended along the limb into the trunk of the tree, thus further reducing its stability.

Hollows in trunks of trees should in all cases be cleaned out, and afterwards filled with cement. Later it will be found that the wood may shrink away from the cement to some slight extent; the cracks so formed should then be filled up with tar or lead paint.

Attention to Drains.

Another thing of importance in orchards where sub-drainage has been carried out is to attend to the outlets of the drains.

Strong growths of rubbish at outlets of drains are liable to encourage the presence of undesirables, such as snails and slugs. If outlets are unprotected by fly-wire, perforated zinc, or some other covering, snails may enter in such numbers as to practically choke a drain for part of the way. But, quite apart from preventing the entry of animal life, it is better practice to keep the outlet drains free from rubbish and weeds.

The Burying of Leaves, Cultivation, etc.

The thorough cultivation of the orchard in autumn is important for the purpose of liberating plant food and for the killing of weeds, &c.; further, the burying of all fallen leaves by ploughing them under makes for hygienic conditions. The burying and the rotting of the leaves destroys many diseases, both insect and fungous, that would otherwise over-winter in them.

An orchard cannot be said to be in a hygienic condition if squares of uncultivated soil, with their accumulated debris, are allowed to remain at the butts of the trees; yet, such strips of uncultivated land are frequently to be seen in otherwise well kept orchards.

A chain is only as strong as its weakest link, and it sometimes happens that these small neglected squares or strips of grass are the weak links in the chain of the work of keeping an orchard clean.

It is extremely difficult, if not impossible, to obtain the best results in the pest campaign so long as these neglected patches are allowed to remain undisturbed.

To attain success in the fight against plant diseases, orchard hygiene is as important as is hygiene in the home if its occupants are to remain healthy.

HOME-MADE BROODERS.

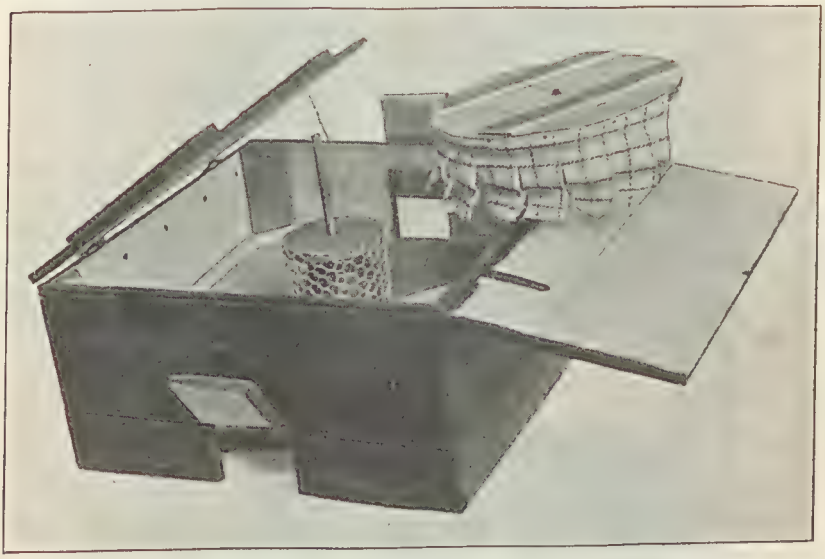
(1) TO ACCOMMODATE ABOUT 80 CHICKS.

By W. O. Pederick, Assistant Poultry Expert.

Make a box 3 feet square by 1 foot deep, and hinge the top so that the chickens can be attended to conveniently.

A lamp chamber can be provided by placing the box on a frame 3 feet square by 6 inches deep. An opening about 6 inches square should be made in one side of this frame so that the lamp can be attended to.

A hole is required in the centre of the floor of the box, and into this hole an inverted flower-pot should be fitted. Some material such as asbestos putty should be used to close up the space between the flower-pot and the floor, so as to prevent any fumes from the lamp passing into the brooder.



One Type of Home-made Brooder.

A small pipe is attached to the hole in the flower-pot; this pipe must be long enough to carry the fumes out through the top of the box. The possibility of poison fumes entering the brooder must always be guarded against. The brooder lamp, which should have a $\frac{5}{8}$-in. or $\frac{3}{4}$-in. wick, is placed directly under the flower-pot.

A piece of wire gauze should be put round the pot to prevent the chickens getting burnt. A round wooden cover about 20 inches in diameter, with strips of flannel tacked around the outside, placed over the pot, helps to retain the heat.

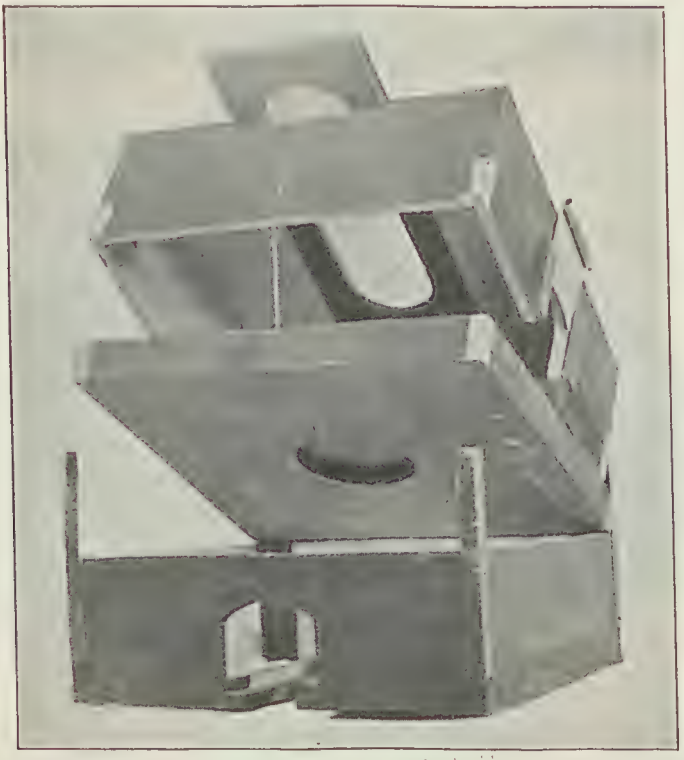
Plenty of ventilation should be provided by boring a number of holes around the top of the brooder close to the lid.

ANOTHER TYPE.

The brooder illustrated below is made in three sections; this makes for convenience in cleaning.

No. 1—the lamp chamber—is a frame 3 feet square, and about 9 inches deep. An opening about 6 inches square should be made in one side so that the lamp may be attended to.

No. 2—the heating chamber—is a frame 3 feet square and 3 inches deep, with a sheet of plain iron tacked on each side. A hole 8 inches in diameter is cut out of the centre of the bottom sheet, and the 8-inch disc is fastened with hoop-iron 1½ inches above this hole. The brooder lamp, which should have a ⅝-in. or ¾-in. wick is placed directly under the hole. The heat of the lamp goes through the hole, and strikes on the disc, and is distributed throughout the heating chamber, and thus warms the top sheet of iron more evenly. A piece of bag covered with dry sand is placed over the top sheet of iron which forms the floor of the brooder.



Another Type of Brooder.

No. 3—the brooder chamber—is 3 feet square and 9 inches deep, and is like a box without a bottom in it. It fits neatly over No. 2. Plenty of ventilation is provided in the top of the brooder by fitting in a small wire netting frame, which can be removed when the chicks require attention.

Providing a Run for the Chicks.

When using brooders of this type, it has been found advisable to provide a small run for the chicks for the first few days. The run can be made from a shallow box about 3 feet square and 1 foot deep with the top and one end removed. It should be placed against the brooder so that the floor of the run will be level with the floor of the brooding chamber. This contrivance will prevent the chicks from getting too far away from the brooder, and there should be no difficulty in teaching

them to go to and from the heat as they require it. The chicks should always be fed and watered in the run, and not in the brooding chamber.

After seven or eight days the small run can be removed and replaced by a ramp which will allow the chicks to get down to the ground. In fine weather they should be given access to a nice green run, and also to the sunlight, as direct sunlight (not through glass) has a very beneficial effect on growing chicks.

A Good Mixture for Chicks.

A mixture made from the ingredients specified below has given very satisfactory results in rearing chickens:—

80 lb. maize meal.
40 lb. ground wheat.
20 lb. ground hulled oats.
20 lb. bran.
6 lb. charcoal.
5 lb. bone-meal.
20 lb. dried buttermilk.
5 lb. fine shell grit.
1 lb. salt.
1 lb. superphosphate.

This mixture can be given either as a dry or a wet mash. The usual custom is to have a dry mash always available, and to feed a wet mash a couple of times during the day. It can be fed from the first feed when the chicks are two days old until they reach maturity. For a scratch grain, 40 lb. cracked wheat, 80 lb. cracked maize, and 20 lb. cracked hulled oats make a very good mixture.

POTATO COMPETITIONS.

By J. T. Ramsay, Potato Expert.

ROMSEY.

There was a satisfactory entry for these competitions for the past season, 18 being received in all. The dry weather in the early portion of the season had a very harmful effect, particularly on the early crops, with the result that these were exceptionally light, and not at all a fair indication of the fertility of the soils in the district, or of the ability of the farmers to handle the potato crop. For years it has been recognized that the potato growers of this district have given close attention to cultivation, with the result that they have established a considerable seed trade connexion. This is due in very large part to the attention given by the Romsey district growers to purity of stock. The effect of this attention is that seed buyers can rely on getting pure stocks of the variety wanted.

Besides the adverse weather conditions, a factor considerably influencing the yields was the prevalence of Early Blight, which affected the leaves so severely that their power to function was curtailed, and considerable reduction in the yield resulted. The tubers of the early crop, however, were very clean, but the late crop showed a fair degree of affection by Rhizoctonia, or Collar-stem Rot, which has been very

prevalent throughout the State this season. In order that this latter disease may be checked, it is highly desirable that a general practice of dipping in formalin solution, prior to next planting season, be adopted by potato growers. The strength of solution advocated is 1 lb. formalin to 30 gallons water, and the period of immersion 1½ hours. If this be not generally adopted, there is considerable danger of next season's crop suffering very extensively from the ravages of the disease.

As usual, in the Romsey district, the standard of cultivation as regards cleanness and evenness of the crop was very high, as is expressed by the points awarded under these two headings.

With regard to the late crops, some very satisfactory yields were obtained, the winning crop being calculated to go 9 tons 7 cwt. to the acre. Growers are evidently realizing the benefit accruing from the closer spacing of the crop, as shown by the fact that only one out of the 18 entries had the crop spaced wider than 29 rows to the chain. This is a very marked improvement which has resulted directly from the influence of these crop competitions, and is very gratifying.

The details of the points allotted are given hereunder:—

EARLY CROP COMPETITION.

Grower.	Rows per Chain.	Cleanness.	Evenness.	Quality.	Weight.	Points for Weight.	Total Points.
Possible Points ..	—	**10**	**10**	**40**	—	**40**	**100**
					tons cwt.		
Bowkett Bros. ..	30	9	9	39	3 7	40	97
L. C. Eaton ..	29	10	9	40	2 12	31	90
P. J. Sheehan ..	31	10	9	34	2 12	31	84
J. Else ..	29	10	9	37	1 19	23	79
W. J. Anderson	31	9	10	38	1 11	18	75
F. Newnham ..	30	9	8	38	1 7	16	71
A. Thorburn ..	32	9	9	38	1 6	15	71
S. Anderson ..	31	10	8	36	1 5	15	69
P. Mitchell ..	32	9	6	35	1 8	17	67
McConnell Bros.	34	9	8	36	18	11	64
Spring Bros. ..	32	10	9	34	17	10	63
J. Doyle ..	25	10	8	35	16	9	62

LATE CROP COMPETITION.

Grower.	Rows per Chain.	Cleanness.	Even-ness.	Quality.	Weight.	Points for Weight.	Total Points.
					tons cwt.		
P. J. Sheehan ..	30	10	8	37	9 7	40	95
Bowkett Bros. ..	30	10	9	38	8 11	37	94
P. Mitchell ..	31	9	9	37	6 13	28	83
Spring Bros. ..	30	10	9	38	4 6	19	76
S. Anderson ..	32	10	9	37	3 14	16	72
McConnell Bros. ..	32	9	9	36	3 9	15	69

In allotting the points for weight, the maximum of 40 is given to the heaviest crop, and to the others pro rata.

Only the weight of the market sized tubers is calculated.

PORTLAND.

There was a noticeable falling off in the number of entries this year in the competition at Portland. Nine entries were received in all, but only five were submitted at the date of judging. The season was certainly adverse, and crops for the most part were lighter than usual. but this condition was general throughout the State, and was insufficient reason for the competition receiving such light support.

Of the crops judged, the cultivation and evenness of crop were good, as is shown by the points awarded, while the quality also was of a high standard.

In the Portland district growers are not yet paying sufficient attention to the closer spacing of the crops, only two out of the five entries being spaced at the distances strongly advocated by the Department of Agriculture, and proved by innumerable tests to be productive of the best yields, both from point of view of weight and quality. Very wide spacings between the rows, such as are represented by 26 rows to the chain, mean waste of ground, additional labour in keeping the crop clean on account of the opportunity given for weed growth, and a tendency to produce tubers not only of less tonnage per acre, but of coarser quality.

The crops for the most part were very clean, with the exception of a slight scab affection in one case, which was due to Rhizoctonia, or Collar Stem Rot. Though this disease is fairly common, it is quite easily controlled by treating the seed with a formalin solution—1 lb. to 30 gallons water, for 1½ hours.

A noticeable feature of the competition was the marked increase of 1 ton 17 cwt. per acre by the crop scoring second highest points over that scoring third. This was due to a dressing of 1 cwt. of sulphate of ammonia per acre being applied just prior to the flowering stage. This result is remarked upon for the benefit of growers in the district.

The points allotted are as follows:—

Name.	Rows per Chain.	Cleanness.	Evenness.	Quality.	Weight.		Points for Weight.	Total Points.
Possible points ..	—	**10**	**10**	**35**	—		**45**	**100**
					tons	cwt.		
A. J. Woods ..	30	9	9	34	9	2	45	97
R. Kerr ..	26	9	9	32	8	7	42	92
E. J. Kerr ..	26	9	9	32	6	10	33	83
C. Oakley ..	26	10	7	32	6	5	32	81
T. Thomson ..	29	9	8	33	4	7	22	72

KORUMBURRA.

Fifteen entries were received for this competition, and, considering the dry period at the early portion of the season, the weights of crops recorded were highly satisfactory, and, indeed, in the case of the heaviest crops, were phenomenally good. This reflects credit on the growers, and is very tangible evidence of the known characteristic of the Korumburra soils to retain moisture, provided reasonably good preparatory cultivation and inter-cultivation is given.

The crops for the most part were very free from disease, and, as indicated by the points given for quality, were of a fairly high standard. It was very noticeable that close attention had been paid by competitors to the important point of keeping their crops clean, as will be seen from the points allotted under this heading.

That the conducting of these competitions is having a beneficial effect on the growers of this district is evidenced by the greater attention paid by the majority to the closer spacing of the crop, which undoubtedly was a considerable factor in producing the high yields obtained this season, and the high average standard of quality.

The following are the details of points awarded to the various competitors:—

Name.	Rows per Chain.	Points for Cleanness.	Points for Evenness.	Points for Quality.	Weight per Acre.	Points for Weight.	Total Points.
Possible Points ..	..	**10**	**10**	**35**	..	**45**	**100**
					T. C.		
A. H. Brown ..	39	10	9	30	12 17	45	94
C. L. Aeschliman ..	32	9	9	33	11 11	40	91
W. C. Rout ..	29	10	9	34	9 11	33	86
A. Wynne ..	28	9	9	33	9 15	34	85
D. J. Davis ..	22	8	8	33	9 16	34	83
O. Sario	30	9	8	32	8 16	31	80
Wynne Bros. ..	28	9	9	34	8 0	28	80
J. Beamish ..	28	10	9	33	7 0	23	75
J. McKinnon ..	28	10	8	32	7 5	24	74
F. Hastings ..	26	8	8	30	7 13	25	71
J. Share	34	10	8	31	6 1	21	70
W. Tulloch ..	29	10	8	29	6 4	22	69
E. Rowe	30	9	7	31	6 3	22	69
R. J. Holmes ..	28	8	8	34	4 16	17	67
G. Rowe	31	9	7	32	4 14	17	65

In allocating the points for weight a maximum of 45 was given to the heaviest crop, and the others *pro rata*.

WESTERN DISTRICT OAT TESTS.

STRATHKELLAR RESULTS.

Although considerable damage was done by cutworms to the crops in the Oat Tests at Strathkellar last season, satisfactory yields were obtained, but, unfortunately, the accuracy of the results was affected to some extent.

The plots are located on black volcanic soil on the farm of Mr. G. Kerr, and the oats are sown after peas. This practice gives a better result at Strathkellar than where the oats are sown after bare fallow. A comparative test of the two practices carried out over the past five years shows a difference of 5½ bushels per acre in favour of oats after peas.

The manurial tests so far carried out have demonstrated that superphosphate is the most effective fertilizer, and that at Strathkellar it pays to use up to 2 cwt. per acre.

The yields from Bone Manure and Basic Phosphate were less than that obtained from the plot treated with a similar amount of superphosphate. Additions of lime, at the rate of 10 cwt. per acre, to superphosphate have produced little or no increase in the yield, though there is a marked improvement in the plumpness of the grain on the plots so treated. On this field during the past three years some response has been obtained from applications of nitrogenous fertilizers where superphosphate has been used as a basal manure. An average increase of 5 bushels an acre was obtained when 44 lb. of ammonium sulphate was used with 1 cwt. of superphosphate. A further period of test, however, is necessary before the exact nature of the increase is determined, and before a departmental recommendation for its use on similar soils can be made.

The yields for the last year, together with the averages over the nine years in which the tests have been in operation, are shown in the following table:—

MANURIAL TRIALS.

Plots each ½ acre, sown on pea fallow. Seed 65 lb. per acre.—Manure as under.

	Yield, 1928.*	Average yield 1920–1928.
	bushels per acre.	bushels per acre.
No manure	41·2	45·6
Super. 1 cwt.	69·9	64·0
Super. 2 cwt.	70·1	68·2
Super. 3 cwt.	63·7	65·8
Basic Phosphate, 132 lb. per acre	72·5	60·5
Bone Manure, 1 cwt.	64·9	61·9
Super. 1 cwt., Lime 10 cwt. per acre	70·6	67·4
Super. 2 cwt., Lime 10 cwt. per acre	62·7	68·3
Super. 1 cwt., Ammonium sulphate 44 lb.	63·2	69·2†
		Five Years' Average, 1924–28.
Super. 1 cwt per acre (after peas)	71·0	63·4
Super. 1 cwt. per acre (bare fallow)	63·4	58·0

* Yields affected by cutworms. † Three years only.

Over the nine years' period the unmanured plot had given an average yield of 45.6 bushels per acre, whereas where 1 cwt. of super. per acre had been applied the average yield was 64 bushels, an increase over the unmanured plot of 18.4 bushels per acre. With a dressing of 2 cwt. of superphosphates per acre the average yield was still further increased to 68.2 bushels, or 22.6 bushels better than the unmanured plot. If the value of the oats be taken at 2s. 6d. per bushel, and the cost of the superphosphates at £6 a ton on the farm, the increased monetary return due to the fertilizer was 40s. per acre in the case of the 1 cwt. per acre dressing, and 44s. 6d. per acre with 2 cwt. of superphosphate. No appreciable increases in yield have been obtained as the result of applications of lime made in 1920 and 1926.

As with the manurial tests, the variety trials were affected by the attacks of cutworms. Palestine, an early variety which was cut a fortnight earlier than the other varieties, escaped the pests and gave the highest yield (82.3 bushels per acre). Algerian, on the other hand, yielded 63.5 bushels per acre, while the Wild Oat x Ruakura crossbred returned 65.5 bushels per acre. The average yields of the three varieties over the nine years' period are:—Palestine 68.8 bushels, Algerian 63.4 bushels, Wild Oats x Ruakura 56.0 bushels per acre.

In a comparative test of the wheat varieties, Warden and Sterling, the former again proved superior, yielding 40.2 bushels per acre against the 29.5 bushels given by Sterling. This test has been in operation for 8 years now, and over that time Warden has given an average yield of 34.3 bushels per acre, while Sterling has averaged 28.6 bushels per acre.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

PRUNING.

Pruning operations will now be in full swing. In pruning the young trees, heavy pruning will be required in order to produce strong growths and a good frame, but as the tree advances in age the pruning will be reduced considerably. It should be remembered that strong, heavy pruning results in wood growth, and that weak pruning steadies the tree, and promotes an even growth. When framing and building a tree, the former consideration is observed, and when the tree is coming into fruit bearing or is mature, it will be pruned according to the latter. Any operation that will cause the tree to produce less wood growth will induce the tree to become more fruitful, provided the tree be in a healthy condition; so that when trees are mature, pruning operations, as a rule, should not be severe, but rather the reverse.

Old fruiting wood, and dead and dying wood should always be removed, and aged spurs should be considerably reduced, in order to make them produce new growths. Crowded and overlapping laterals should be shortened back; fruit-bearing in the higher portions of the tree should not be encouraged; and due consideration should be given to the admission of light and air to all parts of the tree.

Where varieties of fruit trees are prone to bearing crops every second year, their lateral system should be pruned so that they will not produce too heavy a crop in the fruiting year; and at the same time they will produce wood in their fruiting year to give a crop in the subsequent season.

A model tree will always be light on its topmost leaders, bearing the major portions of the crop in the lower regions of the tree. The main point to be noted is that a heavy wood growth in the upper portion of the tree tends to reduce the bearing capabilities of the tree in its most useful parts.

DRAINAGE.

The rains of winter will always show the necessity for draining orchards. Where under-soil drains do not exist, the trees are bound to suffer. If the damage is not immediately apparent, it will be later found that in some way loss will accrue. Either the tree will be weakened by the loss of roots through rotting, or it will be devitalized so that it will not carry a satisfactory crop of fruit. Too often surface drainage is relied on to remove the so-called surplus water. There should be no surplus water for surface drains. The water is only surplus or excess when it is in the soil. Two circumstances, and two only, permit of surface drainage. First, when it is necessary to carry away excessive stormwater; and, second, when it is practically impossible to find an outlet for under-drains, owing to the low-lying situation of the area.

The term "surface drainage" does not apply to open drains, which, owing to their depth, act also as soil drains; neither does it apply to graded surfaces which allow a more equitable distribution of water. Surface draining is usually applied to a system, whereby a considerable quantity of water is removed by gravitation before it enters the soil. Such a system cannot be too roundly condemned. As much water as can be obtained by natural means should be induced to enter orchard soils; and then whatever is in excess will be carried away by under drainage, provided that drainage, either natural or artificial, be in existence.

Where suitable drainage is not provided, the tree roots are compelled to remain in a few inches of surface soil. Their feeding area is thus extremely limited indeed; and when, at any time, rain-water does filter and penetrate through the soil, it carries with it the soluble and other plant foods, below the reach of the tree roots.

Soil ventilation is only possible with a system of drainage, and air is as necessary to the roots of a tree as it is to the foliage. By the removal of the surplus water and the consequent admission of air into the soil, the soil temperature is rendered far more equable, warmer in winter and spring, and cooler in summer; and such a change must be beneficial to the trees.

Drainage is thus an essential for all orchard lands. When natural drainage occurs, the orchardist is fortunate; but whether natural or artificial, a system of drainage will always materially increase the crop of fruit, strengthen the trees, and considerably add to their term of life.

Drainage schemes should be carried out at the present season of the year. In closed drains, such drainage media as cinders, charcoal, stones, brushwood, timber, logs, or tile pipes may be used, but the latter generally give more satisfactory and permanent results. They are also less liable to silting up than any other material.

Drains should be placed into the clay, if this be not too deep. In any case, they should be below any possible interference from cultivating instruments.

SPRAYING.

In order to keep in check such pests as Bryobia, scale insects, woolly aphis, and others, a strong and forcible spraying with lime sulphur, nicotine—sulphate, or red oil spray should not be delayed any longer. The whole tree should be thoroughly wetted with the spray. A good, vigorous, and thorough winter spraying will place a large majority of the trees in quite a satisfactory condition of freedom from these pests for the whole year.

The lime sulphur spray is an excellent fungicide, and a strong winter spray will go a very long way in reducing any attack of the black spot fungus on either the apple or the pear. In addition, if the peach trees are sprayed at this time with lime sulphur, both peach aphis and peach leaf will be considerably minimized in the spring time.

The Flower Garden.

Digging in the garden should be continued. Before digging, the beds should be given a top dressing of lime or stable manure, and subsequently these should be dug well into the soil. Care must be taken not to injure the roots of any shrubs, trees, or roses. Root cutting and root pruning will always dwarf any plant. In digging, it is not wise to discard any leaves, twiggy growths, or weeds. Unless they are required for the compost heap they should always be dug into the soil. Leaf-mould is especially useful in any garden, and where such plants as Azaleas, Rhododendrons, Paeonies, Liliums, &c., are grown, or for pot-plant work, it is exceedingly valuable. In forming the compost heap, no medium whatever should be added to help the rotting down of the leaves unless it be a little sand. Any chemical added will render the mould unsuitable for its special objects. The plants mentioned above strongly object to lime.

All shrubs that produce flowers on their young growths, including roses, should now be pruned. Care should be taken to distinguish between those shrubs that flower on the new wood and those that flower on the wood of the past season's growth. Those that flower on the new wood, and may now be pruned, are Lantana, Cestrum, Tecoma, Hydrangea, Plumbago, Erythrina (some species), &c., and those that should not be touched at present time are Spirea, Erythrina (some species), Pyrus Japonica, Weigelia, Prunus pissardi, P. Vesuvius, P. mume, Deutzia, Polygala, Ceanothus, &c. It is a safe rule in pruning shrubs to wait until they have flowered before pruning. This will certainly give the shrubs a somewhat ragged appearance in the winter, but it is the only way to secure the best flowering results.

All herbaceous plants, such as Salvia, Aster, Delphinium, Polygonum, Boltonia, Gaura, and Chrysanthemum, should be cut back, and, if necessary, lifted and "heeled in" in a temporary location for the winter. Plant out early Gladioli, Iris, and Liliums.

Continue digging, manuring, and trenching.

The Vegetable Garden.

Seedlings from boxes or seed plots may now be planted out. Care should be taken that all vegetable beds are well raised and thrown up. By throwing up the soil, and thus deepening the paths and the spaces

between the plots, the latter are well drained, and the soil is made considerably warmer. This will greatly facilitate the growth of the young plants.

Asparagus may be planted; sow seeds of carrots, parsnips, cauliflowers, onions, peas, broad beans, and tomatoes, the latter being forced on in a frame, so as to obtain good plants quickly.

REMINDERS FOR AUGUST.

LIVE STOCK.

HORSES.—The feeding and general management of horses recommended for July will also apply for this month. Horses, more especially young ones, running on low-lying country are liable to become affected with internal parasites. This will be recognized by the unthriftly and poor condition of the animals; in such cases medicinal treatment will be necessary. If the following lick be made available, it will not only be of great assistance in preventing serious invasion, but in cases where worms are not in large numbers, the repulsion of them from the intestinal tract will result:—

Lick.

20 parts salt.
10 do. lime.
1 do. sulphate of iron.

If possible be with mares at foaling, so that the navel cord may be properly tied and thoroughly treated with antiseptic, and thus prevent that very fatal disease, navel or joint ill. Wash cord with one part of corrosive sublimate to 3,000 of water, and soon after paint with tincture of iodine. The iodine treatment must continue till the cord has completely dried up.

CATTLE.—Continue to give milking cows the advantage of either shelter or rugs. Rugs should be removed on any day while temperature is above, say, 60 degrees. An occasional curry-combing will conduce to the comfort of rugged animals. Continue to graze-off or soil-out the green oat or other cereal crops. If cows scour, remove them from the crop earlier in the day, and in any case don't let them remain on the crop after their appetites have been satisfied. If soil is too wet and "pugs" with tramping, it will be better to cut the green material and throw it over the fence to the animals. Try to keep the crop down below 9 inches high; it is better for the crop itself, and better for the cows. Under winter conditions it is better that cold and watery fodder be somewhat limited, and the difference made up with some drier food such as hay or chaff. Meet any falling yields that are due to the seasonal combination of checked herbage-growth and increased appetite, with hand-feed designed both to amplify and balance the paddock food-supply. Watch the falling yields, and test out the efficiency of concentrate to check them. Take warning at cows (either milking or dry) losing condition and feed them better. The service of the main herd may now all be completed as opportunity arises. Feed the bull amply with balanced material to maintain him fit for the heavier seasonal work. See that calves have a grass paddock on which to nibble and exercise, a windbreak for shelter, and a well-drained spot, as dry as possible, on which to camp.

PIGS.—Supply plenty of bedding in warm well-ventilated sties. Keep sties clean and dry, and feeding troughs clean and wholesome. Feed pigs a balanced ration in automatic feeder when no skim milk is available. Provide plenty of charcoal and ashes. If pigs are lousy dress with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin. Application of waste crude oil from the motor car is an effective way of destroying vermin. Disinfect sties. Worms are very prevalent at present, and may be treated by giving 2 to 10 grains of Santonin. This may be given in the food. Provide green crops for pigs to graze, i.e., oats, barley, rape, artichokes. By grazing on green crops with

balanced ration in self-feeder, better and more economical results will be obtained. Good grass and clover or lucerne or millet for summer grazing are very satisfactory. Always provide plenty of clean water for pigs to drink, especially suckling sows. These also will do much better when grazing than when confined to a sty.

SHEEP.—Late lambing in the wetter districts of the State should end with this month. Late lambs are usually the result of joining the rams as late as March; this should be confined to strong cross-breds and sheep with a predominance of English blood. Lambs dropped in August do well if the district be late or if there be available for them before they are weaned summer grasses and forage. In most places such feed can be grown only by means of irrigation.

In the early northern districts of the State preparation is now being made for shearing. Early shearing is advisable where it is intended to fatten quickly old ewes, early-dropped lambs and two-tooth wethers unsuitable for wool production.

The decision should now be made as to the breed and number of pure-bred rams required for the coming season. Place orders as soon as possible; breeders can then give satisfaction and allot preference to early applicants only. Purchase rams from registered flock-owners. Breed and class should be given most careful consideration. Certain districts and pastures suit one breed or cross better than another. This knowledge can be gained only from the experience of others, or by trial after mature judgment by the sheep-farmer himself.

POULTRY.—Yards should be turned over with a spade or fork, and sown down with rye grass, rape, or barley. Keep the breeders busy—straw litter with a little grain scattered about will make them exercise. Overhaul incubators, disinfect; see that the capsule of thermostat acts properly; thoroughly clean lamps, egg drawers, and chimneys. Test machine for two days before putting eggs in. It is also advisable to have thermometer tested. When additional incubators are required, it is more satisfactory to keep to the one make.

CULTIVATION.

FARM.—Work land where necessary for summer crops. If required, roll or harrow crops. Plant very early potatoes in forward districts. Sow mangolds.

ORCHARD.—Complete planting and pruning of deciduous trees. Watch for peach aphis, and spray with tobacco solution, if present. Prepare for planting citrus trees. Spray for woolly aphis with lime sulphur or red oil spray.

FLOWER GARDEN.—Finish digging and pruning of roses, &c. Leave pruning of shrubs till after flowering. Keep weeds in check; weed out seed beds. Divide and plant out all herbaceous plants, such as phlox, delphiniums, rudbeckia, &c. Plant out gladioli. Complete planting of shrubs. Mulch young plants.

VEGETABLE GARDEN.—Top-dress asparagus beds; plant new asparagus plots. Plant herb divisions, and potatoes. Sow cabbage, cauliflower, peas, carrots, beans, radish, and lettuce seeds. Sow tomato seeds in a hot frame. Finish digging.

VINEYARD.—August is the best month for planting vines (grafted or ungrafted). This should be actively proceeded with and completed before end of month. Scions for field grafting may still be preserved as detailed last month, or better still by placing them in cool storage. They should all be removed from vines before middle of month, at latest. Complete pruning and tie down rods. The value of the prunings for use as "smudge fires" to protect against spring frosts should not be overlooked. A deep winter ploughing is strongly recommended. This must be completed before root action starts in August. The roots may be cut with impunity whilst the vine is dormant, but to do so after root action starts injures the vine. Preventive swabbing with acid iron sulphate solution, of sultanas and other susceptible sorts, to control vine Black Spot, is emphatically urged. Though no damage was caused by this fungus last season, it showed itself in many localities. A showery spring would permit its rapid spread on untreated vines. Neglect of swabbing may spell disaster. A bulletin dealing with Black Spot and its treatment will be supplied on application. In some districts erinose will necessitate treatment. Swabbing and also spraying with lime-sulphur (1 in 12) at the close of winter are effective against this mite.

CELLAR.—Rack again, towards end of month (spring racking), wines which have as yet only been once racked. Fill up regularly all unfortified wines. Clean up generally in cellar and whitewash walls, woodwork, &c.

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